BELL LABORATORIES RECORD

SEPTEMBER 1946 VOL. XXIV No. 9

A monthly magazine for members of Bell Telephone Laboratories, for their associates in the Bell System and for others interested in the progress of the communication art.

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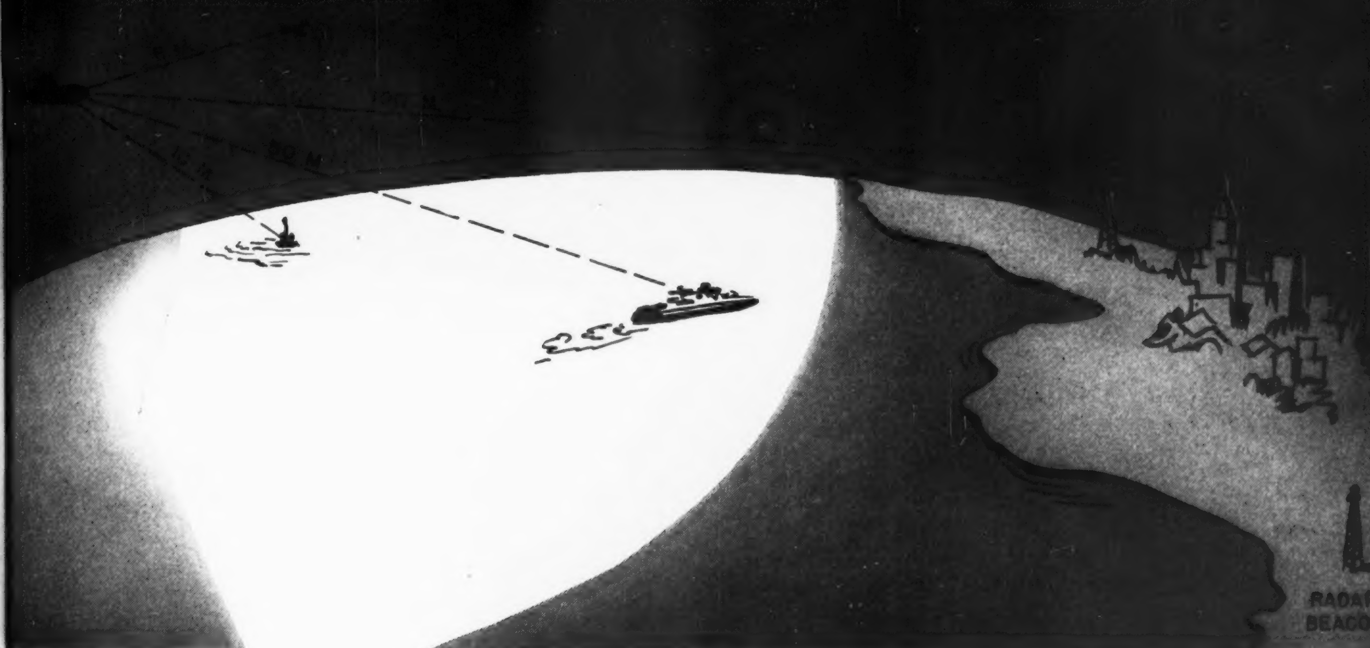


Airborne Search Radar

By J. H. COOK
Radio Development

Microwave radar development for military use reached a remarkable stage of advancement in the few short years devoted to its study. At the war's end, a great number of different equipments suited to specific military needs were in use. In addition to numerous land-based and shipboard radar sets, many equipments were designed for operation in military aircraft, where they performed functions ranging from simple location of enemy planes or ships to precise spotting of military targets for the controlled release of bombs and other projectiles.

By early in 1942, aircraft radar equipments had been developed that operated on wavelengths as short as 9 cm but weighed 400 pounds or more. Reasonable angular discrimination with waves of this length required antenna apertures of 30 inches or greater. This large exposed size and heavy weight restricted the use of microwave radar to large airplanes and blimps, leaving the necessarily smaller aircraft used on Navy carriers without the advantages of the microwave system.

It was at this time that the Laboratories, at the request of the Navy Bureaus of Aeronautics and Ships, undertook an accelerated development program leading to the manufacture of the ASH, later coded AN/APS-4, radar equipment for use on carrier-based aircraft. The successful development of this light and compact design by the Laboratories, and the subsequent manufacture of nearly 15,000 equipments and auxiliary spare parts by the Western Electric Company, constituted a major contribution to the war effort.

The photograph at the top of the page shows an AN/APS-4 in action. White segment indicates area of scanning.

The model AN/APS-4 radar equipment seen in Figure 1 comprises a streamlined, pressure-tight, bomb-shaped unit weighing approximately 130 pounds, and six small units: junction box, control unit, and two cathode-ray tube indicators, each with its associated amplifier. These small units, which together weigh approximately 20 pounds, are mounted inside the aircraft. The large unit containing antenna, power circuits, transmitter and receiver hangs on a standard bomb rack under the wing of the aircraft. It looks like a bomb, and like a bomb it can be jettisoned by the pilot to prevent its capture by the enemy, or to lighten the plane when it is necessary to regain top-flight performance of the airplane.

This equipment, which operates at a

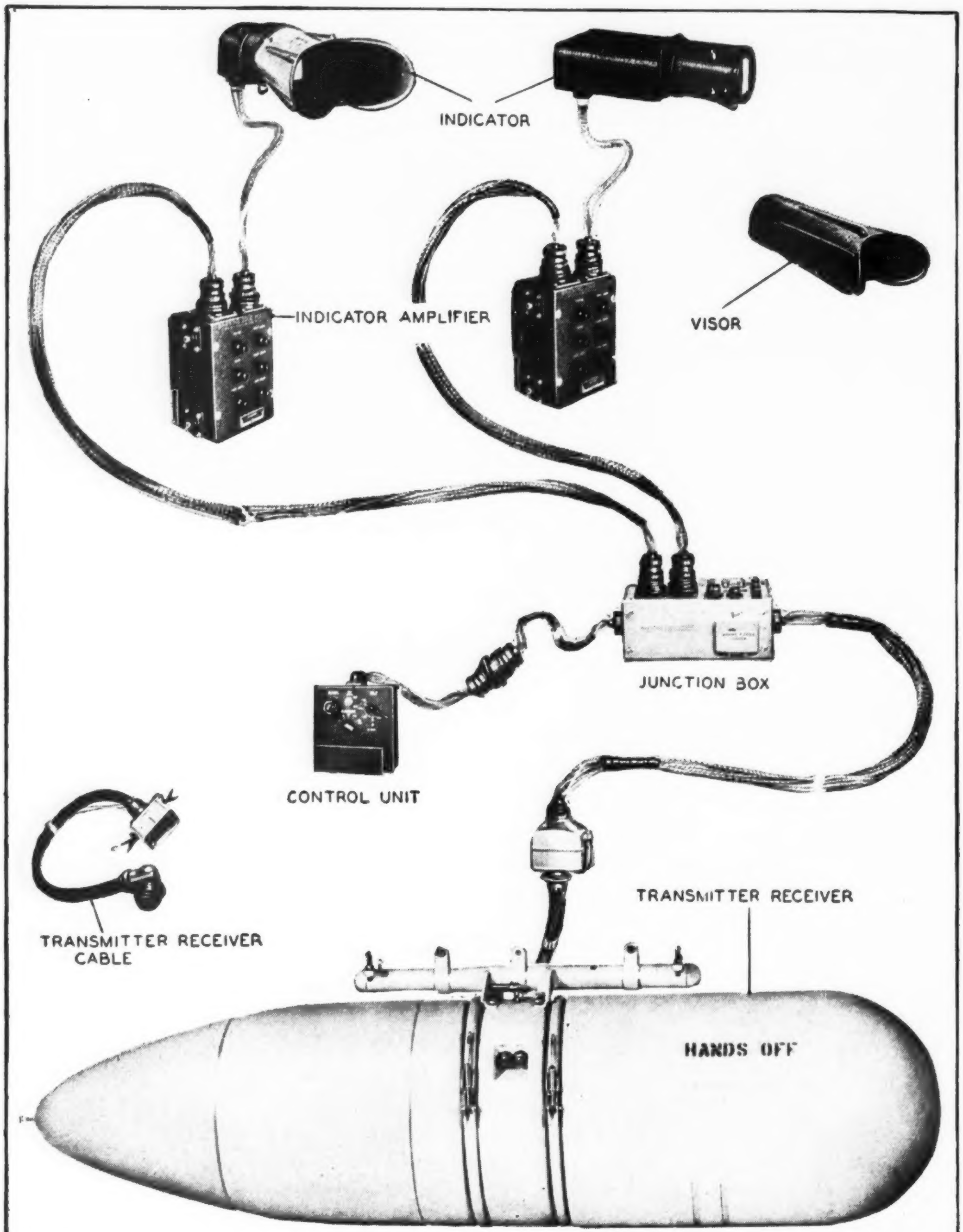


Fig. 1—The main components of the AN/APS-4 aircraft radar equipment

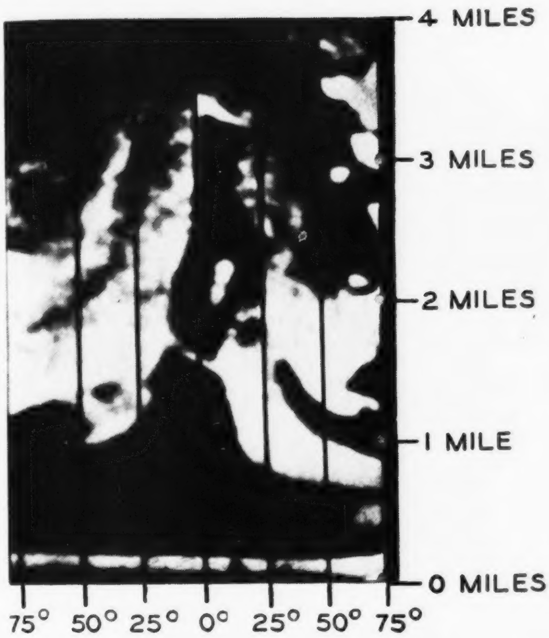


Fig. 2—Typical land map indications as they would appear on the scopes

wavelength of 3.2 cm, provides a radio beam less than six degrees wide with an antenna aperture of only fourteen inches. In operation, the antenna, in the radio-transparent nose, or radome, of the sealed bomb unit, scans horizontally to cover a forward sector 150 degrees wide at a frequency of from one to two times a second. When searching for objects on the surface of sea or land, the elevation angle of the radio beam is changed on alternate scans to trace out a two-line pattern—thus covering a band twelve degrees wide, six degrees for each line of scanning—but when searching for another aircraft, a four-line pattern is used, giving a band twenty-four degrees wide. At the same time the tilt of the scanning radio beam may be smoothly controlled by the pilot or operator to give a range of view extending from about thirty degrees above to about thirty degrees below the searching aircraft.

The equipment normally generates pulses of radio power at levels of 30-40 kw lasting two-thirds of a microsecond. During transmission the receiving circuits are blocked by a gaseous discharge switch, but within a few microseconds after cessation of transmission, the receiver regains full sensitivity to radar echoes from objects in the antenna beam. These echoes, detected and amplified, are used to modulate the intensity of the cathode-ray tube indicator producing a spot of light which persists for some seconds. A type "B" indicator which presents the range or distance of an echo and its angular position on a horizontal plane is used. This is illustrated in Figure 2. The spot-forming beam in the cathode-ray tube is deflected vertically to depict the range of the echo, and moves horizontally across the face of

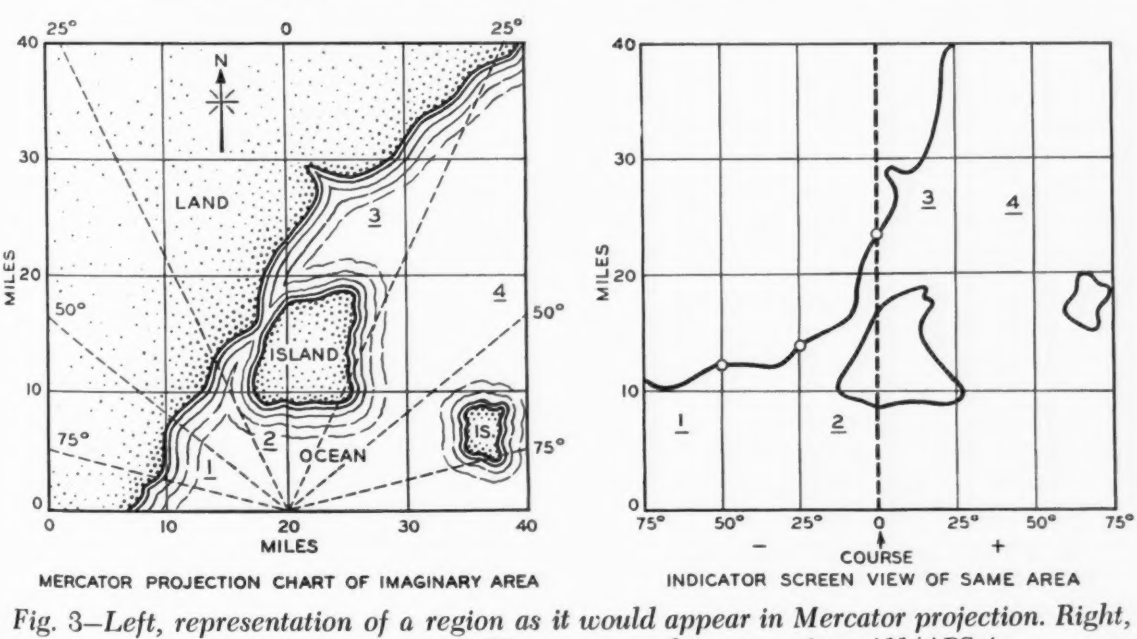


Fig. 3—Left, representation of a region as it would appear in Mercator projection. Right, the same region as it would appear on the scope of an AN/APS-4

the indicator screen in proportion to the horizontal angular motion of the antenna to show the bearing of the echo. The resulting screen picture is a distorted map of the area being scanned. In an ordinary map, such as shown at the left of Figure 3, distance north and south is represented vertically and distance east and west, horizontally, while the bearing of any point from the middle of the base line is measured directly by the angle between the base and the line connecting the two points.

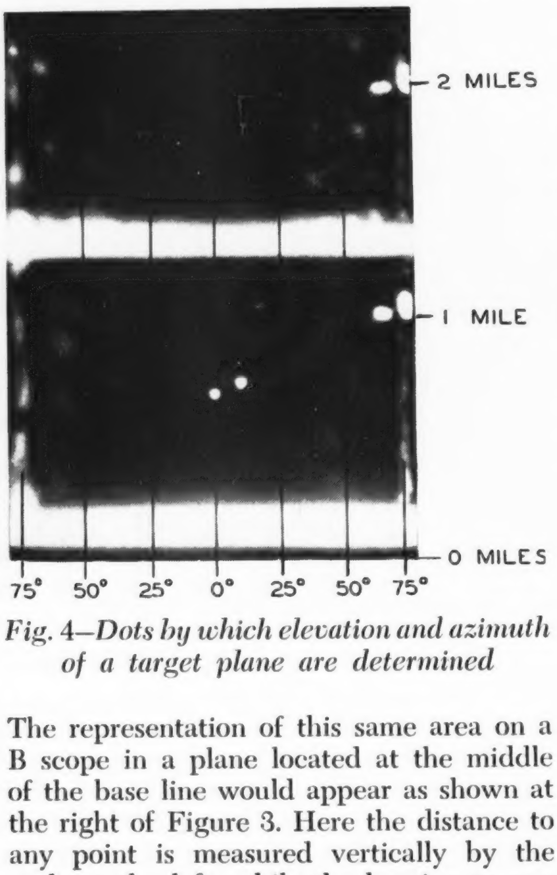


Fig. 4—Dots by which elevation and azimuth of a target plane are determined

The representation of this same area on a B scope in a plane located at the middle of the base line would appear as shown at the right of Figure 3. Here the distance to any point is measured vertically by the scale at the left, while the bearing to any point is measured horizontally by the scale along the lower edge. Although providing a distortion of contours, such a presentation has the advantage for military use that the bearing angle discrimination does not deteriorate at close range.

The AN/APS-4 may also be used to determine the relative elevation of another aircraft so that it can be intercepted in flight. For this use the indicator screen shows two spots of light, Figure 4, separated horizontally a short distance and displaced in such a way that the angle between the line connecting the two dots and a horizontal line through the left-hand one indicates the angle of the target plane above or below the scanning plane. The left-hand dot represents the position of the target plane—range and bearing being taken from the two scales of the scope.

The AN/APS-4 radar equipment can also provide information as to the identity of target aircraft or ships by presenting a coded signal on the indicator screen when the target is interrogated by and responds to associated I.F.F. (Identification—Friend or Foe) equipment. For navigational purposes the AN/APS-4 is equipped to interrogate microwave beacon stations also and to display coded responses from them showing their location and identity at ranges approaching 150 miles.

Complete records of the maintenance history of this equipment have been made available to the Laboratories. This information has served as a guide for the many changes that have been introduced during the course of production. More than 2,700 change orders were processed during the twenty-three months in which approximately 15,000 equipments were delivered.

The matter of weight, always important in aircraft operations because each pound of equipment displaces an appreciable amount of fuel with corresponding lessening of flight range, is of particular importance in carrier-based aircraft because of their small size and restricted take-off facilities. A strenuous and continued effort to reduce unnecessary mass in the AN/APS-4 resulted in a reduction of total weight from 180 pounds for the first production equipment to 150 pounds for the final equipments manufactured.

The operational record of the AN/APS-4 has not yet been published, but scattered reports reaching the Laboratories indicate that it has been eminently satisfactory. Several interesting testimonials to the usefulness of the equipment are quoted below from the Airborne Coördinating Group Digest, a Navy periodical devoted to radio and radar maintenance.

"The ASH radar works well with the many jobs we are called upon to do," Lt. Sperry wrote, "and those jobs included not only searching out Japanese targets, navi-

Fig. 5—AN/APS-4 installation on an F4U-4E plane—U. S. Navy Photo

gating in strange territory and homing to their carrier, but also helping the pilots fly 'in, over and around' tropical rain squalls and point out targets through overcast."

"Our surprise attack out of the sun was highly successful with many bomb and torpedo hits, . . ." "We retired from rendezvous, leaving the target burning and dead in the water."

"The weather between us and the CV was steadily becoming worse, but by using the radar scope in conjunction with my maps, we steered in, over and around the rain squalls and unfamiliar islands to the outer end of the San Bernardino Straits, which we easily identified by radar."

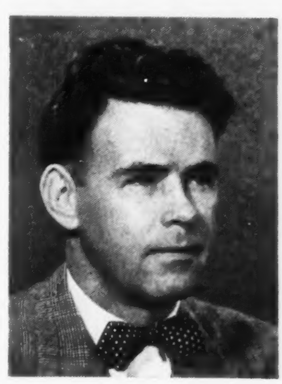
A strike group "flew through heavy weather to Karenko on Formosa, where the flat area around the town was easily distinguished from the surrounding mountains and identified by the strike leader's ASH radar. We let down through a hole in the clouds to sink and burn shipping in the harbor and blast nearby factories."

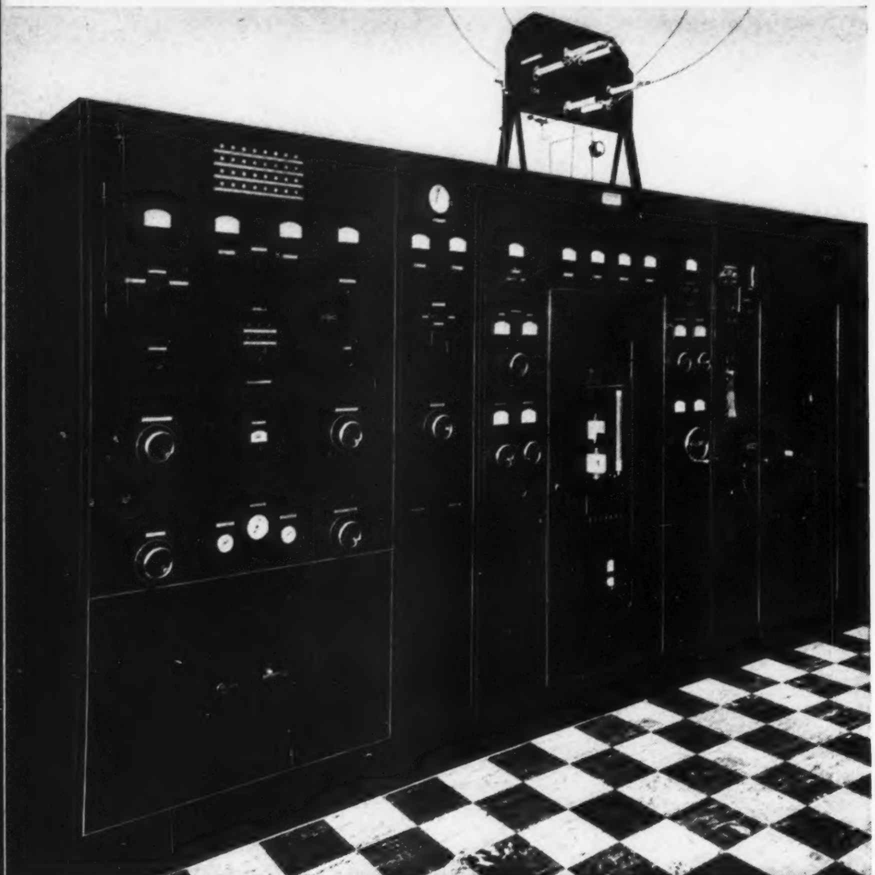
"The next morning the strike group climbed above the heavy weather on the east side of Taiwan and flew up the coast line on the seaward side of the large port of Kiirun. We used ASH radar to home in on prominent harbor landmarks and approached Kiirun over the solid overcast at 10,000-foot altitude."

The division led a strike on Tarien air strip on the northwest tip of Formosa. "We approached the island above the overcast and were well orientated through use of ASH radar. The position of our target field was plotted by bearing and distance from the distinct coastline and by the nearness of a winding river. . . . We made a surprising and successful attack, doing much damage to enemy airfield installations."

Development of the AN/APS-4 radar equipment required the well-coördinated activity of people from many departments of the Laboratories. Proper recognition of these efforts would require listing several hundred important contributors. As with most of our developments, no one person and seldom one group carries the entire load.

THE AUTHOR: JACKSON H. COOK, after receiving an S.B. degree in Electrical Engineering from M.I.T. in 1936, took graduate study at Harvard and M.I.T. during the following two years. He was Research Assistant with the Electrical Engineering Department of M.I.T. from 1937 to 1940, Consultant to the NDRC during 1940 and 1941, and Research Associate at the Radiation Laboratory from 1940 to 1944 with the Modulator and Engineering groups. He came on leave to the Laboratories in 1941, where at Whippany he engaged in radar development. During 1942 and 1943, on leave to the Navy Department, he was Senior Engineer (radio) in charge of all three-centimeter aircraft radar design. He returned to the Laboratories in 1943 to become Project Engineer on the AN/APS-4 radar described in this issue of the RECORD.





Transoceanic Radio Amplifier

By C. F. P. ROSE
Radio Systems Development

When the transatlantic radio-telephone service was inaugurated on January 7, 1927, the rate for a three-minute call was seventy-five dollars. Today the corresponding rate is twelve dollars. Continual research, development, and redesign, coupled with good management, are the chief factors which have made such a reduction possible.

The initial transatlantic service was by long waves—52 kc in one direction and 57 kc in the other. While long-wave transmission was still under development, studies of short-wave transmission were being carried on at Deal, N. J., and commercial short-wave service was inaugurated in 1928.* By 1935, when a transpacific link joined telephones of the United States with those of Japan, the system had expanded from transatlantic to transoceanic in scope. The overseas traffic was carried by ten short-wave transmitters at Lawrenceville and Ocean Gate, N. J., and at Dixon, Calif.

Experiments were continued at Deal, however, to improve the radio transmitting equipment, and from these efforts came a single-sideband transmitter to replace the double-sideband transmitter. Single-sideband transmission offers the equivalent of about eight times the useful power provided by double-sideband transmission. In 1938 newly developed equipment was installed providing either double or single-sideband transmission as desired to meet the alternative demands imposed by both types of equipment at the overseas stations.

In 1939, additional newly designed low-power radio transmitters were installed to meet the continually increasing traffic demands. The new design provided twin-channel single-sideband transmission. This type of transmission conserves space in the radio spectrum by transmitting the intelligence of two channels in three-quarters of the space required by double-sideband transmission. The two channels are associated with the same carrier but one is separated from it by a region wide enough to avoid inter-channel interference. This low-power equipment became the Western Electric D-156000 Radio Transmitter.* It not only embodied the new features mentioned above, but also minimized the operations required for changing frequencies that were made necessary by diurnal and seasonal variations in the transmission paths.

The transmitter consisted of a 2-kw unit that could be used either as a short haul transmitter or to drive a 60-kw two-stage amplifier for transoceanic service. The two-stage amplifier did not lend itself readily to rapid frequency changing so a further development program was initiated at Deal to provide an improved amplifier to be used with the basic 2-kw unit. This program culminated in the Western Electric D-158974 Radio Amplifier, which was turned over to traffic at Lawrenceville in June, 1942.

Featuring facilities for rapidly changing its frequency, this transmitter is capable of

*Record, *August*, 1929, *pages* 481, 487 *and* 497.

*Record, *March*, 1941, *page* 202.

operating at any assigned frequency within the range from 4.5 to 23 mc. Furthermore, it must stand the daily grueling test of continuous operation for twenty-two hours out of every twenty-four. Safety features have also been stressed in the design, and the system prevents personnel from entering any compartment until all voltages have been removed and circuits grounded. For protecting the equipment, provision is made so that the various voltages can be applied only in a specified sequence.

In contrast with its predecessor, the amplifier itself has only a single stage. All controls are brought to the front of the unit, thus making it unnecessary to gain entrance to the unit to change frequencies. Simplicity has been further secured by reducing as much as possible the amount of rotating machinery required. Another improvement is the location of much of the associated power supply out of doors. A single-stage construction was made possible by employing four 25-kw tubes in a single circuit instead of eight 10-kw tubes employed in a two-stage amplifier. In addition to the amplifier, there is a control unit and a high-voltage rectifier unit. The three units are bolted together and all mounted on a common channel-iron base as shown in the headpiece, where the control unit is at the left and the rectifier at the right. The space occupied measures 4 feet by 15 feet on the floor and is 7 feet high. This represents only one-third of the equivalent floor space required for previous comparable equipment. All electrical connections, except those to the antenna transmission line, enter through the floor. The two radio-frequency antenna leads pass through a pyrex glass panel on the top of the amplifier to an external antenna selector switch. Intercabinet wiring is run in conduit through the sides of the cabinets.

A schematic of the amplifier is given in Figure 1. Four Western Electric type 340-A single-ended, 25-kw water-cooled vacuum tubes are connected in a push-pull bridge-neutralized circuit with the two tubes on each side of the circuit connected in parallel. The operating characteristics for these tubes are similar to those of the vacuum tubes used in the early models of the Western Electric 50-kw broadcast transmitters. Excessive heating of the copper-glass grid seal, due to high-frequency losses, was eliminated by air cooling the seal.

Frequency changing through front-of-panel controls was accomplished by the design of the two output tuning coils illus-

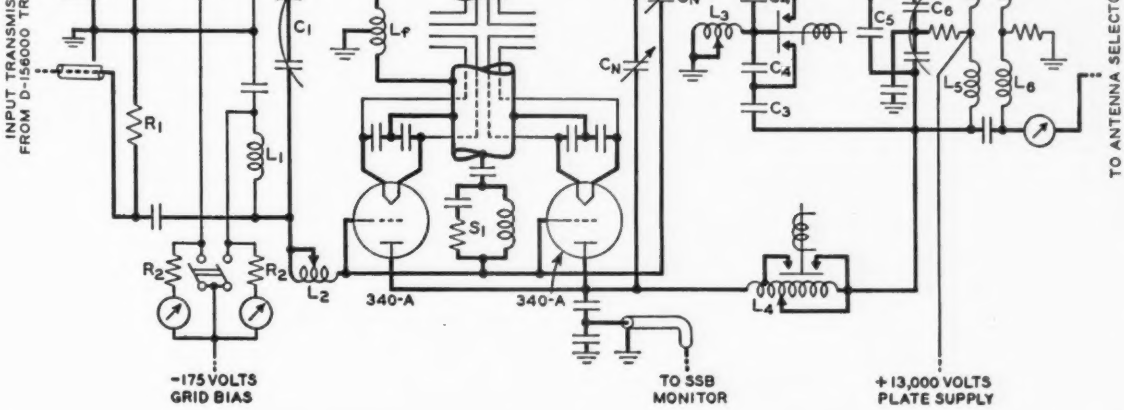


Fig. 1—Simplified schematic of amplifier

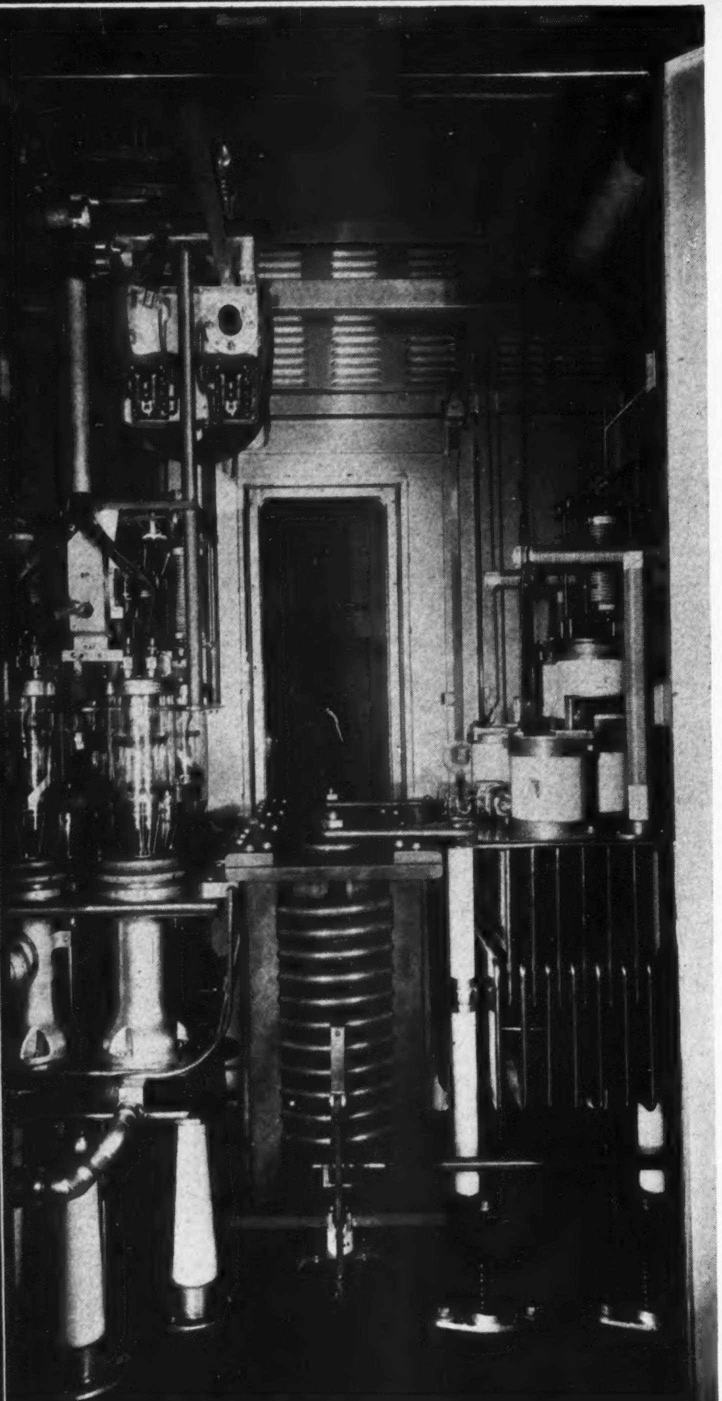


Fig. 2—View of part of the amplifier showing the remote controlled tuning coil in the lower center section

trated in Figure 2. The unused end of each variable coil is short circuited through a sliding contact moving on the inner periphery of the coil to prevent parasitic voltages from being developed when only a few turns are actively in the circuit. An additional device for short circuiting the unused portion of the coils, shown in the front of the photograph, is necessary to overcome other undesirable resonances within the operating range. This is a solenoid operated device automatically controlled by a limiting switch actuated mechanically when the sliding contact passes a preselected point on the coil.

Since these coils have to carry 150 amperes of radio-frequency current, they are water cooled. The coils consist of eleven turns of ¾-inch outside diameter copper tubing formed to a diameter of 9.5 inches. About one gallon of water per minute is required to cool each coil. This water is bypassed from the cooling supply of the vacuum tubes, and if the inlet connection were made at one end of the tuning coil and the outlet connection at the other, the coils would be short circuited by the metallic jacket of the tubes. This is avoided by using a double tube construction for the tuning coils with a smaller tube inside the larger—with the outer tube being connected to the inlet supply and the inner tube to the outlet. In this way the tuning coil itself is metallically connected to the water supply at only one end and is thus not short circuited. By the use of special fittings in the two ends of the tuning coil, water enters the annular space between the tubes and after passing through the entire length of the coil it enters the inner tube, passes back up through the length of the coil and then out.

A radial sliding contact is rotated on an axial shaft and the thread action of the turns moves it to the desired tuning point. Differential gearing permits simultaneous adjustment of both coils through an insulated shaft connected to a large hand-wheel on the front of the cabinet. When the hand-wheel is pulled out, the shaft to the rear coil is disengaged, and the front coil may be adjusted independently. This adjustment allows compensation for dissymmetries which may develop within the amplifier itself.

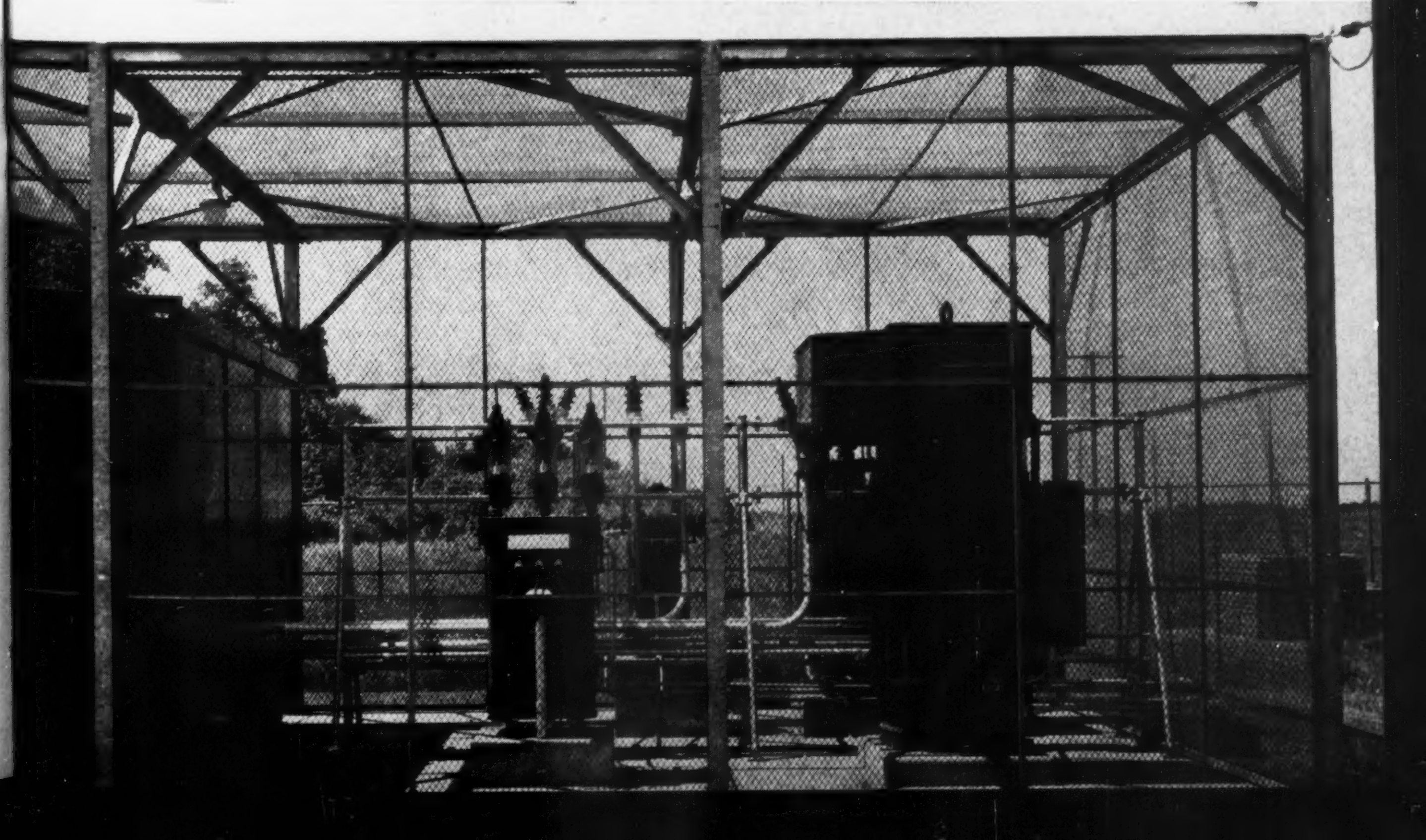
With the former two-stage amplifier, two men required six minutes to enter the amplifier units and change from one frequency assignment to another. With the niceties of these controls, one man now can make the change externally in three minutes. This arrangement represents not only a saving in the cost of operation, but also a decrease in lost-circuit time.

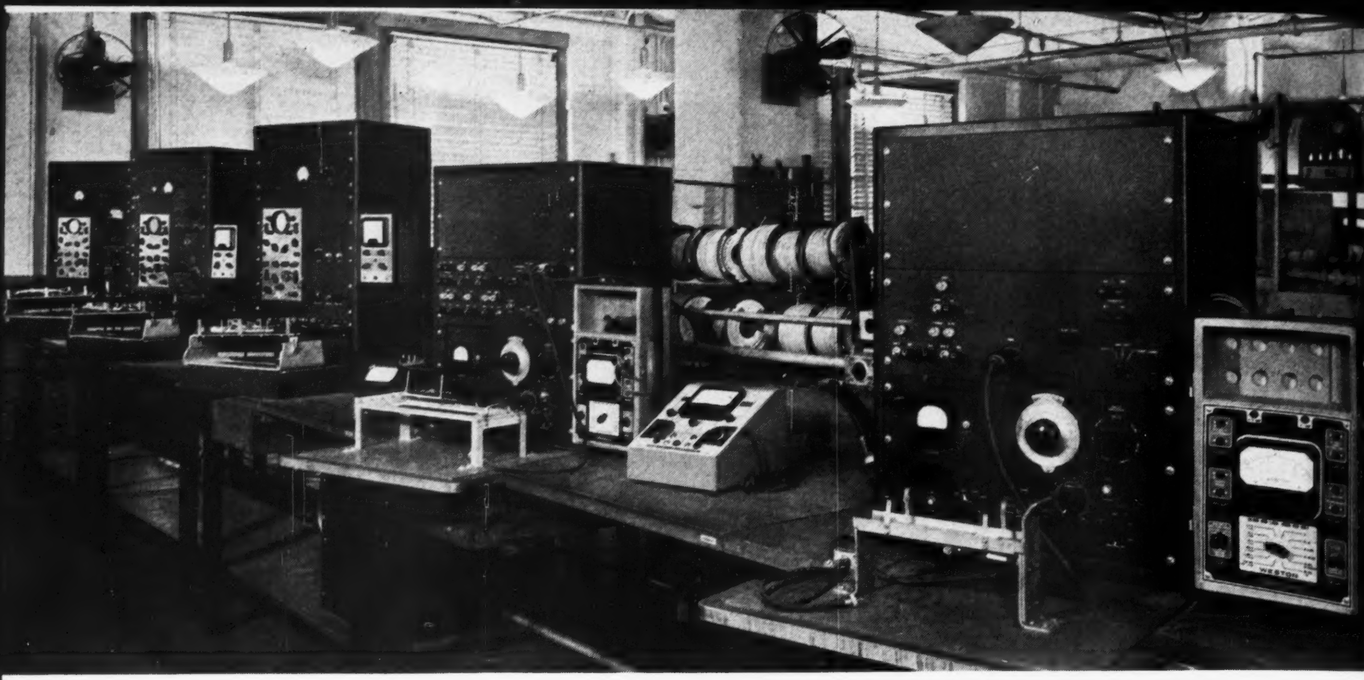
Rotating machinery has been reduced to a minimum by replacing motor generators with rectifiers. Only pumps and fans for the water-cooling system are required. This system is simplified since the previous water-cooled type rectifier tubes are replaced by air-cooled mercury-vapor tubes. The cooling system, similar in principle to an automobile radiator and fan, is located in the building, and is normally unattended. A predetermined water temperature must be attained before the cooling fans operate. Thereafter, thermostats automatically control the number of fans required in accordance with the ambient temperature and the power dissipated.

As much of the power supply equipment as possible is located out of doors, and is illustrated in Figure 3. On the platform, there are the necessary pieces of equipment to transform the three-phase voltage of 4,160 to 230 volts for the low-voltage equipment and to 13,000 volts for the three-phase high-voltage rectifier equipment. The latter voltage is controlled by an automatic three-phase induction voltage regulator. The automatic features may also be disengaged so that the rectifier voltage may be raised and lowered manually. The installation is novel to the extent that the value of voltage at which automatic regulation takes place can be changed over a wide range from a remote point located in the operating room of the station.

THE AUTHOR: CHARLES F. P. ROSE entered the Radio Research Department of the Western Electric Company in December, 1920. He graduated as a Student Assistant in 1924, and subsequently attended Columbia University Extension School. Since 1925, he has served as a Member of the Technical Staff of the Bell Telephone Laboratories. Mr. Rose has been engaged in designing, developing, installing and testing short-wave transoceanic radio telephone transmitters for the Bell System in New Jersey, Argentina and California. During the war he was engaged in developing special electronic equipment used by the U. S. Government. In November, 1944, he was transferred from the Radio Research Department to the Systems Development Department, where he is continuing circuit development work for radio systems.

Fig. 3—*Outdoor power plant for the 60-kw transmitter*





Production of Airplane Radar Speeded by New Testing Technique

By F. P. WIGHT
Special Equipment Engineering

ONE of the important steps in preparing to manufacture complex electrical apparatus is the provision of shop testing facilities. These consist of special testing units, some of them very complicated pieces of apparatus in their own right, that at various points along the production lines are brought into action to check wiring and circuit connections, the functioning of the various component parts, and the overall operation. The design and construction of this testing apparatus is usually undertaken by the Western Electric Company, and requires considerable time—often to the extent of affecting the delivery of the first commercial units. When the Laboratories pre-production program* was begun, this same procedure was at first retained, and the pre-production units were tested with Laboratories' equipment and set-ups devised temporarily to meet the needs of the moment. Such a procedure, however, meant that design engineers were required to spend too much time on pre-production testing, and that because of the shortage of manpower, Western Electric production might be delayed in starting.

When one of the most urgent radar projects came along, it seemed essential to devise some better method of testing. This was a high-quality radar system designed for pin-point bombing from B-29's, with Japan as the target. Delivery time was important, and since it was an elaborate precision job, testing was even more important than usual, and the requirements were more severe. As a result, the engineers responsible for the development and planning of this equipment in the Western Electric Company and the Laboratories agreed to design the shop test sets concurrently with the development of the system, and to build these test sets in the laboratory along with the pre-production models. This plan was carried out on this project, and the test sets were proven in on the laboratory pre-production models, and then used in the factory to test the first regular production lots.

The radar set is made up of a number of electrical and mechanical components and sub-assemblies so as to meet space and weight requirements for plane mounting, to facilitate replacements and maintenance, and to permit manufacturing, assembling and testing by production line methods. Early analysis of the project for factory test purposes indicated that testing would be required at forty-one positions, and that twenty-eight distinct types of mechanical

*RECORD, *May*, 1946, *page* 188.

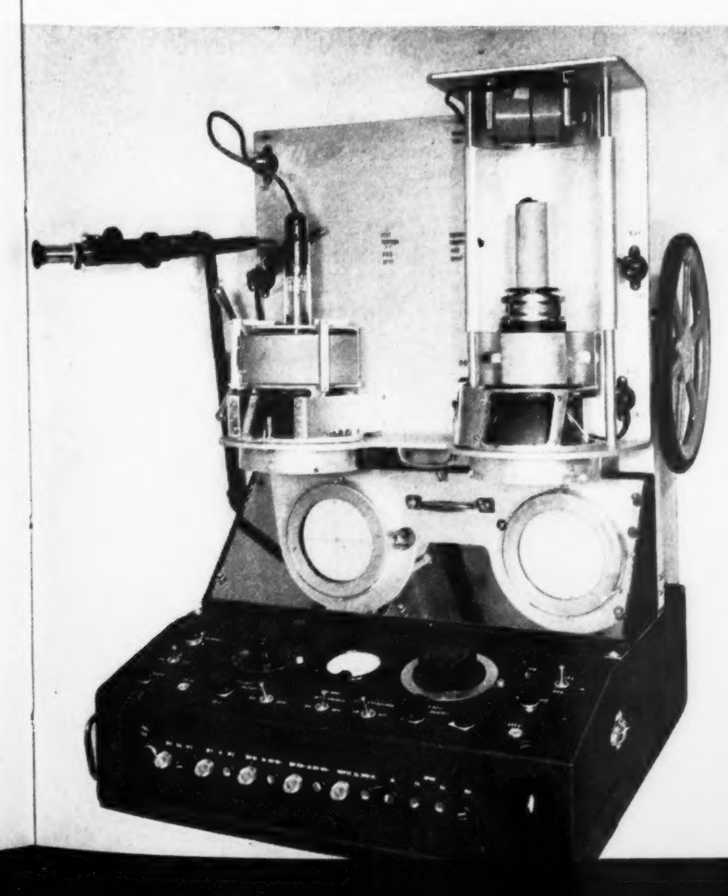
and electrical test equipment would be required. These test facilities were as special and in some ways as complex as the radar equipment they were designed to test.

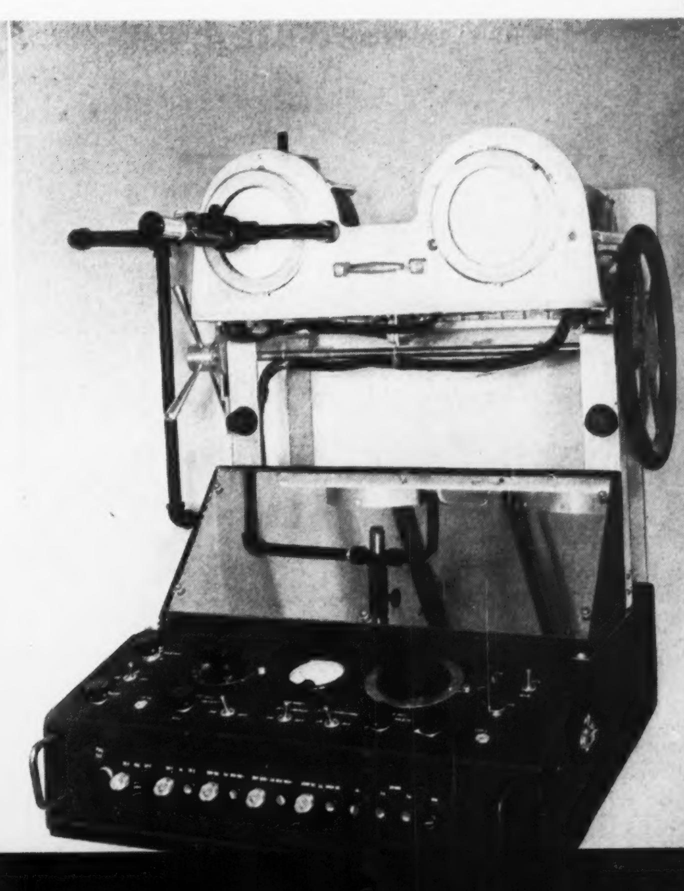
In general, these tests require the determination of correctness of wave shapes, amplitudes, frequencies and band widths, and checks of general circuit functioning, and of mechanical alignments and fitness. In designing test sets, jigs and accessories, it was desirable to centralize all controls and test accessories in the face of or attached to the sides of floor and bench-mounted cabinets, and to locate the apparatus conveniently for operation and maintenance. Provisions also had to be made for rapidly connecting the unit to be tested to the test set without using soldering operations or otherwise attaching or detaching wires, and for providing electrical and mechanical safety features, easy attachment to power services, mobility of all floor-mounted units, and overall durability of all components so as to stand the punishment of continuous use over long periods and to avoid interruptions to operation of the assembly line.

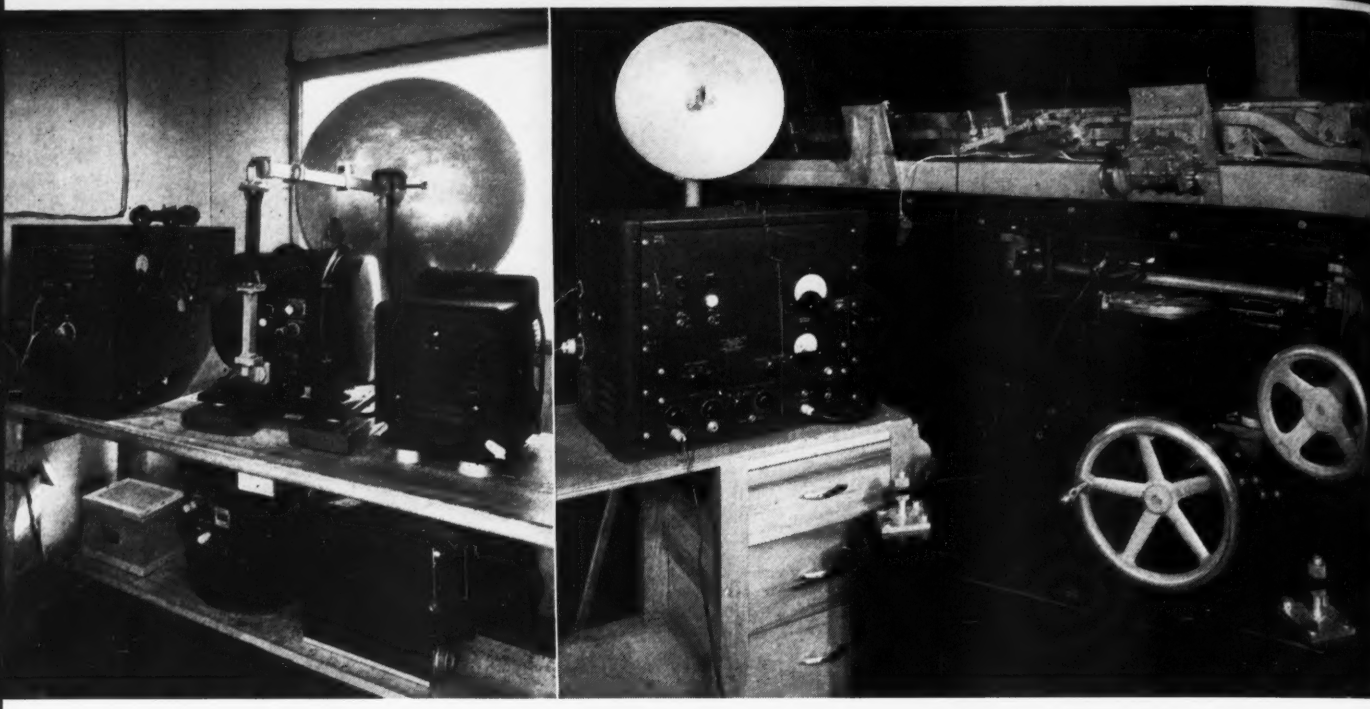
Beginning in April, 1944, general testing theory and proposed testing practices were worked out as rapidly as possible into specific circuit and test requirement data. Then with the aid of Western test planning engineers, specific testing facilities were designed, complete manufacturing drawings were prepared, and one or more sets of each type were made available for preproduction testing at the Laboratories, and also for the Western's first production. Western Electric testing personnel were brought in to carry on the pre-production testing so as to train them for the production job to follow, and to relieve Laboratories personnel (from repetitive testing operations).

For this particular project, the Laboratories built and tested forty pre-production systems at New York, and eighty associated antennas were built by Ex-Cell-O Corporation at Detroit on a Laboratories sub-contract, the Laboratories furnishing all test facilities and being responsible for all testing

The tube assembly test set includes a reference cathode-ray tube at the upper right and the tube under test at the upper left. The mount for these tubes is hinged so that the tubes may be viewed in their normal position, as at the right, or as at the left, tilted down to give safe access for adjustments while the tube is in operation. In the latter position the tubes may be seen in the sloping mirror mounted between the tubes and the set







One of the tests carried out in Detroit used a test transmitter, shown at the left, which was mounted on top of the Michigan Bell Telephone Company's building in Detroit, and an antenna dispersion and pattern test set at the right, mounted on the roof of the building of the Ex-Cell-O Corporation

operations that were carried on at Detroit.

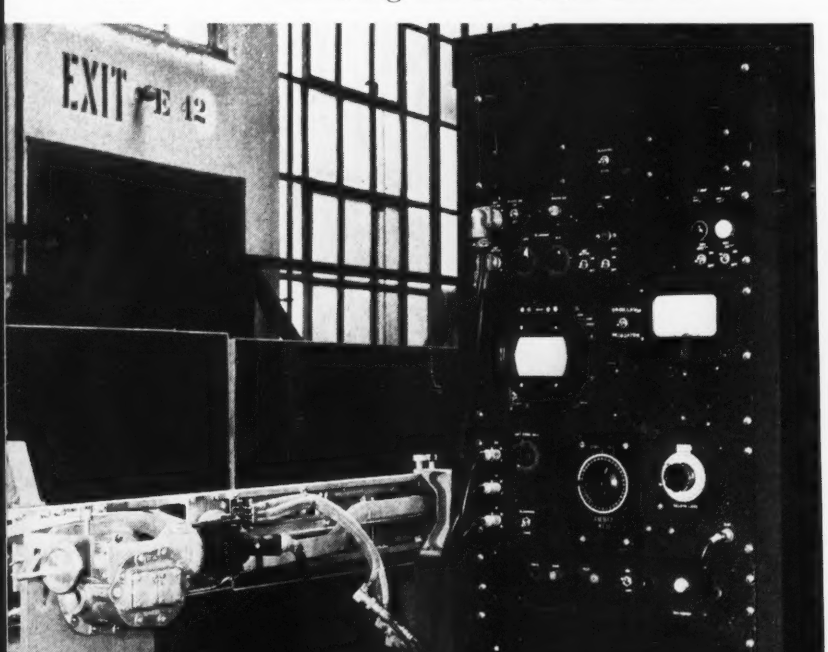
Radar test facilities at New York were ready for use in June, 1944, and were used from July to September in the component and final testing of the pre-production quota. System deliveries to the Signal Corps began late in July, and the required forty systems were completed early in September, 1944—one month ahead of schedule.

Antenna test facilities at Detroit were available in June, 1944, and were used from June to the middle of October in the component and final testing of the antenna pre-production quota. Antenna deliveries to the Signal Corps started about the middle of July and were completed in October, 1944.

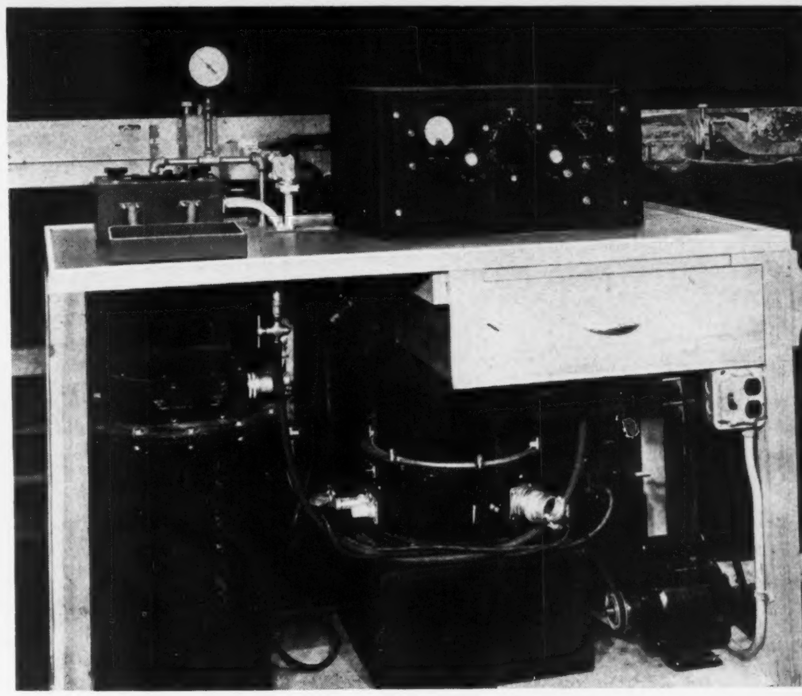
In all, a total of fifty-five test sets of special new types were built by the Laboratories for use on pre-production quantities and to provide the Western with one of each type of set initially. Of these, twenty-six were for use in New York, fifteen for use in Detroit and fourteen for the Western Electric Company. On completion of the pre-production contract, however, all test sets were turned over to the Western for use on the production contract except for a small number having application on other current work.

Perhaps the most unusual feature of the various test sets is the special jig developed to facilitate testing sub-chassis assemblies. These jigs are arranged to provide instantaneous contact between the test set and unit under test by means of flexible action fingers aligned to engage the terminal posts of the sub-chassis. In addition, provision had to be made for sufficient clearances to permit test probing, and a double-hinge arrangement had to be provided to

The size and complexity of some of the testing units are evident from this photograph of the "scanning and sine theta test set"



allow access to the equipment side of a chassis for potentiometer adjustments and tube replacements without disengagement from the test set circuits. As there were six such chassis per system, having an average of twenty-one test termi-average of twenty-one test termi-set connections were involved in testing forty pre-production systems, not including retests and Signal Corps inspections. The use of these jigs proved to be of real value in saving time. Perhaps of even greater importance was the avoidance of potential trouble due to damaged soldered connections, which might otherwise have occurred through use of alligator clips or actual soldering of the numerous test leads to the terminals of the units.



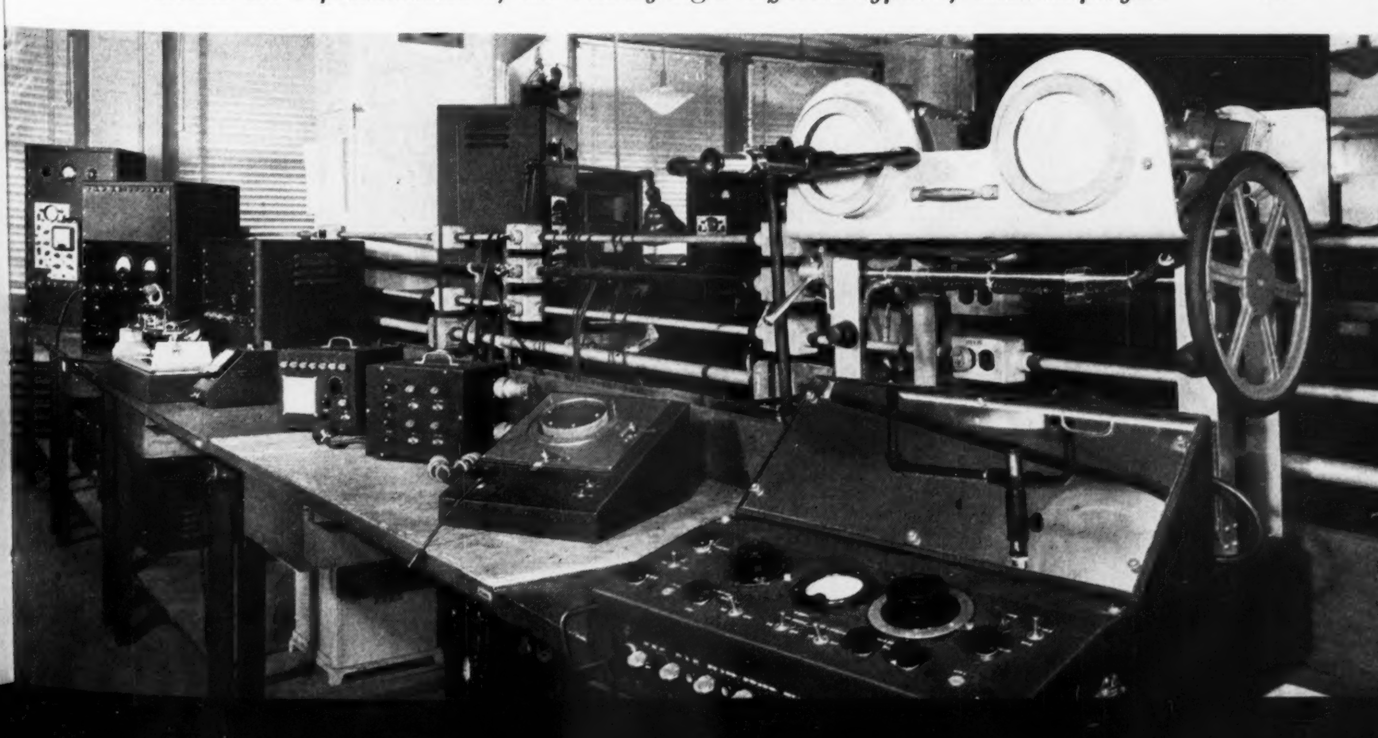
The electrical breakdown test set shown coupled to an antenna at Detroit

The test sets required power supplies of a range of voltage and frequency not normally available from building sources. For tests of radar components at New York, twenty-four power supply units of six different ranges were required. Testing of the antennas at Detroit required fifteen rectifier and motor generator set units of approximately similar range.

The general plan of designing shop test sets concurrently with the development of the system, initiated with this project, was followed currently for other war projects. It was felt that a forward-looking test program of this character would contribute materially to the overall war effort by greatly speeding up both pre-production and production programs.

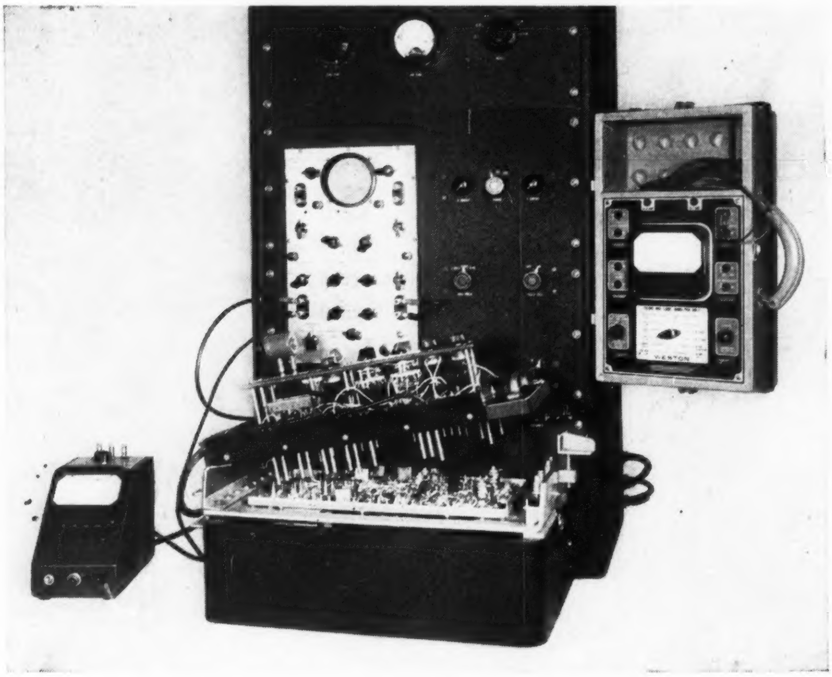
The pre-production program of forty systems was completed a month ahead of schedule, due in a large measure to the availability of adequate testing facilities and a group of testing personnel trained in production methods. Of probably greater importance, the Western Electric's produc-

The seven test sets below and the six shown in the photograph at the head of this article are representative of the twenty-eight different types of units employed

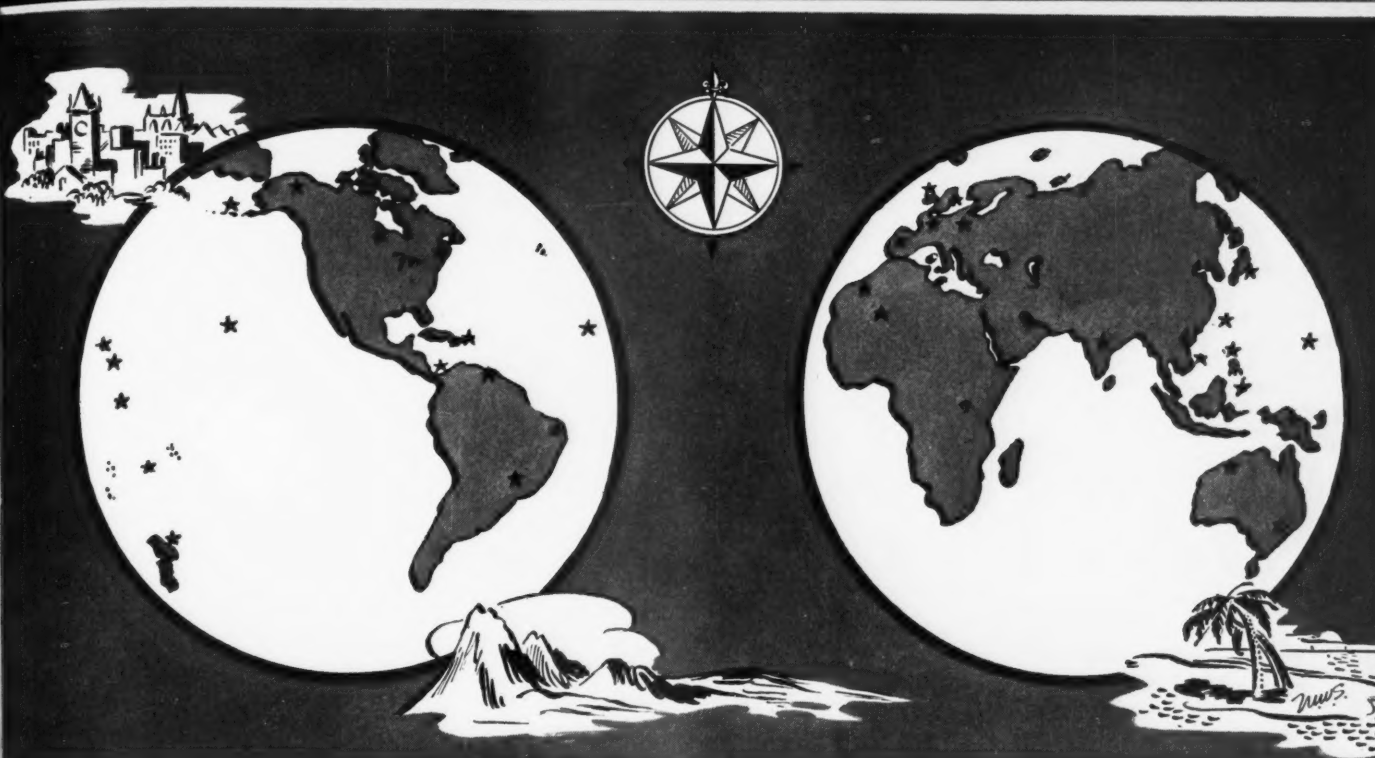


THE AUTHOR: F. P. WIGHT first joined the Equipment Drafting Department of the Western Electric Company in 1926 where, in addition to preparing drawings, he was engaged part time with actual field installations. After a leave of absence to attend Bowling Green State University, he transferred to the System's Drafting Department, where he engaged in the preparation of equipment requirement drawings for toll, radio and central-office facilities. This was followed by successive transfers to the trial installations, current analyzation and switching development groups, where his work involved supervision of construction and subsequent field installations of type-K carrier and telegraph equipment models, the handling of current central-office equipment and installation problems, and finally development of test facilities for the No. 1, tandem and No. 4 crossbar systems. During the war he was engaged in the design and construction of facilities for shop testing of pre-production models for the Armed Forces and took an active part in designing the devices described here.

tion program was helped in many ways. Their test planners, who are familiar with problems peculiar to assembly line production and with the use of comparatively unskilled test personnel, assisted in test set design, and became familiar with the product and the technical problems in advance of start of production. Duplicate effort was avoided, and one type of test set served both pre-production and production. Also, the test sets used, which were of a type definitely suited to production line output, became available when needed to meet production rates and, finally, a group of their own test personnel, trained in the problems of pre-production testing, became available as a nucleus to test the first production output and to train additional testers.



Typical of the jig sets is this navigator's indicator chassis test set. The chassis is mounted face down on a supporting frame and the jig is placed on top of it. Hinges at one end of the mounting permit the chassis to be tipped out for adjustment or inspection



Representing the Laboratories at the Front

By C. B. BARNARD, JR.
Publication Department

AMONG minor miracles accomplished under pressure of war, the feat of converting physicists and engineers of Bell Telephone Laboratories into globe-trotting Messrs. Fixits deserves some consideration. Eighty of them were pried loose from the peace and security of their bell jars and glowing vacuum tubes by the modern psychological alchemy of their country's need, during the struggle and immediately afterward, to become investigators, consultants, observers, and field engineers for the Armed Forces.

From Manila to Munich, from Algiers to Alaska, from Brisbane to Brussels, wherever there was a technical investigation or a concentration of communications or of electronic detection, gun-laying, or bombing equipment, their trails were likely to converge. Some of them speak familiarly (and with distaste) of Kiska and Panama. "I wasn't really overseas," they'll say. "I was in the Aleutians."

The diaries of others carry entries such as: ". . . . arrived Hollandia, New Guinea, March 9, 1945 . . . left for Manila by boat April 26 . . ."; or, "Many of the V-bomb launching sites had been destroyed by Allied bombs or by retreating Germans . . . (but) bit by bit as we examined various sites, we pieced together an exact picture. . . . It rained and hailed during most of the trip. Once or twice we slept on the ground . . ."

PROBABLY the most exciting experience was that of P. V. Dimock, who spent three hours floating around the Atlantic in a life preserver one evening in May, 1944, after an aircraft carrier was blasted out from under him by enemy torpedoes. The carrier *Block Island* was out of Casablanca in the neighborhood of the Cape Verde Islands off the bulge of Africa when, for several nights in a row, its search planes made radar contact with a submarine on the surface, presumably to recharge its batteries. The carrier cruised to the point where the contacts had been made, and one evening about sunset was preparing to launch planes to go after the submarine again.

But the enemy struck first. Two torpedoes slammed into the carrier almost simultaneously, one in the bow and one in the stern. Dimock, who was on board as a representative of the NDRC's Airborne Instruments Laboratory for work connected with airborne submarine detecting devices,

C. W. Vadersen at a forward echelon headquarters in New Guinea

was standing on the catwalk that runs around and slightly below the edge of the flight deck when he felt the carrier lurch.

"My first impulse," he says, "was to grab something solid. I was surprised at the lack of noise when the torpedoes went off."

The carrier's engine room was wrecked and it was lying dead in the water. Dimock hurried to the pilot's ready room below decks to get his life jacket, and was there when a third torpedo exploded amidships, putting out all the lights and jamming the ready room door closed. It took about two minutes "but it seemed a lot longer waiting in the dark" for someone outside to force the door open again.

About ten minutes after the first explosion, the "Abandon ship" order was given. Dimock slid down a rope into the ocean. The rubber rafts were reserved for the sick and wounded, of which there were fortunately few, and the rest of the survivors hung onto the sides of the rafts to avoid being separated. Of four destroyer escorts that were with them, one was torpedoed but did not sink, and the other three began picking them up. The water was warm, Dimock says, and he needed no medical treatment after three hours of immersion, although getting the oil out of his hair was something of a task.

Dimock had taken leave of absence from the Laboratories to join the NDRC group in March, 1942. His first trip away from the States was a shakedown cruise in the Pacific aboard the carrier *Mission Bay* in November, 1943. Then he shipped from the States aboard the ill-fated *Block Island* in April, and it was on the return trip that the sinking occurred. After returning to Casablanca on the destroyer escort that picked him out of the water, Dimock took passage on his old friend, the *Mission Bay*, for the States, where he arrived in June, 1944.

The submarine? Dimock thinks they sank it. The destroyer escorts hunted it with contact mines while he was still in the water, and three of the mines hit something and exploded. Since the D-E's were not molested as they picked up survivors, the submarine was presumed sunk.

Dimock made several more trips aboard carriers, including one to Newfoundland in September and October, 1944, and a few coastwise missions.

One of the most unusual trips was that of A. E. Bowen, who joined the Army and went to Trinidad with an anti-submarine air force squadron, and with an agreement that he could become a civilian again as soon as that particular mission was finished. Bowen had been on leave from the Laboratories, working at Langley Field on devices and techniques for anti-submarine warfare, when the Army decided in September, 1942, that it needed a squadron of radar-equipped bombers in the Caribbean immediately to assist in covering convoys carrying supplies for the North African invasion. They needed Bowen, too, they said, but he couldn't go along as a civilian. He was commissioned a major and became radar and engineering officer for the squadron which was equipped with an early Bell System search radar. He returned to the States at the end of October, resigned, and after a few weeks his resignation was ac-

cepted. Nine months later he rejoined, again as a major, and was promoted to the rank of lieutenant colonel, remaining in uniform until after the end of the war.

A PROJECT for the Signal Corps, still under security wraps, sent Laboratories men galloping all over the globe. J. M. Barstow and R. H. Badgely started this big parade, leaving for England toward the end of May, 1943, and C. R. Gray joined them a month later. From here on the various people, places, and dates are masked by secrecy. Badgely came home in August, and in September left for Honolulu, where he stayed until the following February. Barstow and Gray returned from England in September, but they had a little more time than Badgely to unpack and pack again. They were off in November (still 1943) for North Africa, eventually reaching Caserta, north of Naples, Italy, where they worked until the following March.

In the meantime, other people had come and gone. L. G. Schimpf and Wiley Whitney preceded the other two in North Africa, arriving in Algiers in June, 1943, and returning home in November. C. W. Vadersen, traveling for the same project but in the opposite direction, embarked for Australia in August, 1943, landed at Townsville in the tropical northern part, and thumbed his way south by air to Brisbane while the ship, which had been rerouted, proceeded north to New Guinea with all his equipment. The equipment finally arrived in Brisbane on September 28, and two days later it was set up and working, meeting the deadline which had been scheduled before the ship was rerouted. Vadersen passed part of November with a ten-day trip to New Guinea to survey new sites for the project and to check on other Bell System equipment. He returned to the States in December, stopping off for a few days in Hawaii to see Badgely. Thomas Thatcher wound up the globe-girdling tours for the project with visits to Brisbane, Hollandia in New Guinea, and Manila. This odyssey began in October, 1944, and ended in July, 1945. No one has yet tried to sum up the number of miles the seven of them traveled altogether, but the total probably runs well into six figures.

PERHAPS the first Laboratories man overseas on a scientific mission during the war was Ralph Bown, now Director of Research. Bown was in Lisbon, making connections for the trip home, on the day Pearl Harbor was attacked. He had been in England since September of that year as a representative of Division 14, the radar division of NDRC, to study British radar.

Bown left the country once more in June, 1942, as an expert consultant for the office of the Secretary of War on a flying trip to Panama, Central and South America, during which, among other things, he surveyed radar defense of the Canal Zone.

AT LEAST nine Laboratories communications engineers zig-zagged frantically back and forth across France, Belgium, and western Germany, planning and directing establishment, maintenance, and operation of communications for the Allied forces during the land campaign against Germany. Part of this involved rehabilitation of commercial telephone systems which had been blasted by the enemy.

First of them to reach Europe was D. K. Martin, who arrived in England May 1, 1944, as a War Department representative and was assigned to the United States Strategic Air Forces to serve as expert consultant in radio communications. In September, Martin moved to France and the Ninth Air

D. K. Martin, on his way to München-Gladbach, poses amidst the ruins of Jülich

Force, where most of his activity was concerned with radio relay systems.

L. L. Glezen and L. Pedersen, the first of the wire communications men, arrived in England late in May, 1944. The Normandy landing was soon to come, and they inspected Signal Corps depots in England and taught schools on carrier equipment until the St. Lo breakthrough opened up their big job. They journeyed to France at that time and arrived in Paris early in September where they were attached to Communications Zone headquarters.

Some aspects of the task were heartbreaking. There had been an extensive commercial cable network throughout western Europe, but the Germans had blown up central offices during the retreat and it was necessary to replace destroyed exchanges with Army equipment. Pedersen began by rehabilitating the cable from Cherbourg to Paris and erecting supplementary open-wire lines from Cherbourg to tie in with the Paris-Versailles cable. He opened a consulting office in Paris and Glezen had his headquarters in Rennes, but most of the time they were scurrying around France and Belgium attending breakdowns, reorganizing, rehabilitating, and installing communications.

They were joined at Communications Zone in Paris by R. B. Hearn, who arrived in September, 1944. Hearn specialized in wire telegraph, and in engineering, establishing, and clearing up troubles in teletypewriter circuits. C. L. Cahill, who had already endured one stretch in the Pacific from April to September, 1944, on NDRC contract for radio countermeasure work, reached Paris in January, 1945, just in time to help repair the break in the north-south cable that had forced transfer of northern elements of the First Army to British control. E. J. Noon, who also arrived in January, swelled to five the list of men attached to Communications Zone. Noon and Cahill were originally scheduled to replace early birds Pedersen and Glezen, but there was so much work that all five stayed on and eventually transferred to Twelfth Army Group headquarters at Wiesbaden. Here they switched from French and Belgian equipment to rehabilitation of German cable networks.

The list is not yet complete. W. E. Evans, Jr., had been overseas since December, 1943, as communications section head of the American-British Laboratory, a branch of Harvard's Radio Research Laboratories, which specialized in countermeasures for both radio and radar. Evans came to the 9th Air Force on loan during the winter of the Bulge to help set up radio relay stations. Edward Praizner and P. B. Fairlamb reached the European Theater in March, 1945, to join the 9th Air Force, where they were assigned to forward headquarters. They were concerned with wire communications problems, including installation and maintenance of wire telephone, telegraph and teletypewriter systems and restoration of German equipment. Since the Ninth was the tactical air force which rendered close support to ground troops during the campaign across Germany, it was essential that its headquarters have quick, easy communication with all its units and with various ground force headquarters.

Pedersen began the homeward procession of communications men in March, 1945. May and June were busy months with Martin, Cahill, Hearn and Noon returning. Glezen came home in July after a 3,000-mile jeep trip around Germany, Praizner in August and Fairlamb stayed on until November when he, too, left the European Theater to its own devices.

EVEN before this group of communications trouble-shooters went to Europe, three men from the Laboratories crossed the Atlantic to make special communications studies. In September, 1942, H. S. Black joined a party on its way to England to examine a British microwave radio relay set known as British Wireless Set No. 10, which had just been built on an experimental basis. Black returned in November, and the Laboratories subsequently designed a new microwave radio relay system used extensively by our troops in Europe, the development of which stemmed in part from the studies in England.

In March, 1944, A. B. Clark and Albert Tradup left for Europe as expert consultants for the War Department to investigate and prepare overall reports and recommendations on problems connected with both fixed and mobile communications facilities.

Their travels took them through Algiers, Tunis, Naples, Air Force headquarters in Italy, Fifth Army headquarters, then to England, where they visited numerous flying fields and radio installations. Along the way Clark had climbed Mt. Vesuvius and was taken to that somewhat inaccessible hot spot, the Anzio beachhead, by grasshopper plane. They were in communications headquarters in England on D-Day. When they reached New York in late June, 1944, they had flown about 15,000 miles.

MEAT and shoes and other domestic items were not the only wartime shortages. There was often a short supply of materials more particularly essential to electronic warfare such as mica, a natural insulator which in many cases could not be replaced with synthetic materials. F. J. Given headed the U. S. Mica mission which visited England from May 30 to July 7, 1943, under auspices of the Combined Raw Materials Board and the Harriman Mission to discuss allocation of available mica, of which principal sources were British mines in India and Brazil. It was necessary to correlate American and British needs, to squeeze estimates of both nations down to the predictable supply, and to educate the British in uses of substitutes as well as low-grade mica. These subjects had been studied extensively in America, so that enough high-grade material would be available for essential applications.

OTHER Laboratories men journeyed to England on special projects, ranging from exchange of information to study of new developments. J. R. Pierce and H. D. Hagstrum were there from late October through December, 1944, under U. S. Navy sponsorship, to trade notes on vacuum tubes for microwave radar. Pierce was particularly concerned with triodes, velocity-modulated tubes, and reflex oscillators, while Hagstrum concentrated on magnetrons and enclosed spark gap tubes which the English prefer to call trigatrons. Among other things, they had tea with H. G. Wells, who a year later announced his thesis that there just wasn't any hope for modern man.

C. R. Burrows, who at the time was on loan to the NDRC and has since become head of the Department of Electrical Engineering at Cornell University, was in Eng-

P. B. Fairlamb at the Sulzthal repeater station—the terminal station for the 9th A. F. Hq.—located at Bad Kissingen. German type repeaters and Western Electric ringers are shown

land during the winter of 1943-44 on another mission of particular importance in connection with radio wave propagation studies. Burrows was head of the NDRC Committee on Propagation, which in concert with such distinguished scientists as Sir Edward Appleton, Director of the Department of Scientific and Industrial Research of Great Britain, coördinated studies in the United States, Great Britain and other nations and transmitted the information obtained to the Armed Forces.

Another trip sponsored by NDRC, and the Navy also, was that of T. C. Fry, who examined a number of British Army and Navy installations in England during the months of August and September, 1942. His work had to do with target location and detection. D. E. Wooldridge also visited England during January and February, 1945, at the invitation of the Ministry of Aircraft Production to exchange information on electromechanical bombing devices.

THE M-9 gun director, which instigated the destruction of so many airplanes and buzz bombs that no one has yet come up with a total, dragged a number of Laboratories men to diverse parts of the globe. First to go was R. C. Dehmel, not strictly an M-9 man, who took to England for demonstration a developmental model of the first anti-aircraft director built for British guns. He went over at the end of June, 1942, and returned in September. Then L. J. Kelly left home, journeying only as far as Camp Shilo, 120 miles north of Winnipeg, Canada, where, during February and March, 1943, he put the M-9 over the jumps of winter testing. This experience was something like setting up housekeeping in a cold storage vault since the temperature dropped to 47 degrees below zero while he was there. However, both M-9 and Kelly survived well. By now the recognized expert on how to keep one's M-9 alive in a blizzard, Kelly was off again to Alaska and the Aleutians in May of the same year, staying until October.

C. E. Fordham, who sits at a desk next door to Kelly's, carried matters to the other extreme. He doused himself in sunshine, heat and humidity in Panama from October, 1943, to January, 1944, from April, 1945, to July, and again in October. His praise for the M-9's reaction to climate is as loud and well documented as Kelly's. During the first trip he inspected M-9's in locations where they had been emplaced for action for some time, and on the second and third visits he directed the M-9 part of a formal tropical testing mission in which something like 2,000 items of Army ordnance were checked under carefully controlled conditions.

K. G. Compton and J. Leutritz were also in Panama, courtesy of Army ordnance, from September to October, 1944, and from October to November, 1945, respectively. Their studies were similar to Fordham's but much broader in scope, covering the effects of corrosion and fungus, and of moisture-proofing on many types of radio, radar and electromechanical equipment.

When the M-9 began setting almost unbelievable records in the European Theater, C. A. Lovell and R. R. Hough journeyed overseas to find out if it was all true and to consult with the British about its use. After visiting large numbers of anti-aircraft sites in England and France on a tour that lasted through July and August, 1944, they were able to report that it was. Later on, the records were pushed even higher, as D. B. Parkinson learned on another M-9 inspection tour through Western Europe in April and May, 1945. An all-time record was established in the last week of the buzz bomb "shoots" at Antwerp, when the combination of radar, M-9, 90-mm guns, and proximity fuse knocked down eighty-nine out of ninety-one V-1's.

Not an anti-aircraft device, but closely allied with anti-aircraft radar, was a Laboratories-designed close support plotting board which A. J. Borer accompanied overseas in December, 1944. The board was tied in with ground radar and it prepared information automatically for use in directing bombers through weather and darkness to the target and in timing the release of their bombs. Borer was in England, France and Germany, returning in May, 1945.

Mr. Barnard, a former newspaperman, was a member of the Laboratories from August 6, 1945, to July 28, 1946, when he resigned to explore his capabilities as a fiction writer.

(To be concluded)

The Ballad of the Cedar Ants of Penetang

By R. H. COLLEY
Outside Plant Development

METHODS for control of carpenter ants and heart rot fungi in northern cedar poles were demonstrated last summer north of Toronto, in coöperation with the Bell Telephone Company of Canada. The following ballad, somewhat revised from the original, was read in due and ancient form in celebration of the most successful outcome of the experiments. A few explanatory notes have been added and a more complete, and shall we say more orthodox account of the work, may appear in a later issue; but the reader may or may not learn more from the technical account than from the ballad. Here at least for the time being is the heart of the matter:

Along the roads to Penetang [1]
The cedar poles are smitten,
Their butts and hearts by fungus plants,
Their bodies torn by gnawing ants,[2]
And that's why this is written.

Aroused by Nature's bold attack,
The chiefs at Montreal
Sent kegs of creosote; besides
A water tank for fluorides,
To fight the foe withal.

The combat squads fared forth in spring,
The battle swift began;
With shovels, axes, pipes and picks,
And tapes and prods and poison mix,
The brave inspectors ran.

They dug and measured, bored and plugged,
No single man afraid;
While baronets and engineers
Admired or scoffed or voiced their fears,
And supervisors prayed.

The deacon read the law of chance,
The sacred code of creeds;
And barristers with courtly guiles
Made notes and records for the files,
To document the deeds.

The laird of Aykroyd's [3] brow grew dark.
"The water's running out.
We'll use alone this magic oil,
All by itself, in wood and soil,
And save the poles, no doubt."

A whisper trembled through the ranks,
A gesture of defiance!
"The methods, oil and water, each
Are needed for our test to reach
The verity of science.

"With pentachlorphenol and oil
We have endowed one brew.
We crave, oh sire, the right to feed
This hollow-hearted fungus breed
A fluoride-water stew."

And so the matter was resolved.
The summer months rolled by;
Until one cool October day
They cut the cedar's sides away
To see how ants would die.

They traced the way the poisons worked
By clever alchemies;
How pentachlor and creosote,
And vagrant fluoride had smote
Their two-fold enemies.

By lane and wood and ditch and field
The happy echoes rang;
"The cedars' broken hearts are bound,
The fungus dead, and we have downed
The ants of Penetang."

Which method, now, do you suppose
Was ordered by decree?
You'll find the evidence to date
In P.E.M. one million eight
Eleven four nine three.

[1] A far land, rich in history of the early explorers, about five days' march north of the town of Toronto, in the Province of Ontario.

[2] Probably the common *Camponotus pennsylvanicus ligniperdus var. novaboracensis*, but these small creatures are no respectors of persons and destroy the goods of rich and poor alike.

[3] A gentlemen of Toronto. Perforce his name was left in the line because no other attempt at versing did sound so good as this; and for that matter some other laird may have said it.

Wesley Fuller, Information Manager

Wesley Fuller of the Publication Department is responsible for providing information to Bell System Companies, newspapers, magazines and other publication media. Mr. Fuller, a member of the National Association of Science Writers, was science editor of the *Boston Herald* for some time as well as Boston Correspondent of *Science Service*. In the fall of 1941 he established and served as Executive Director of the Red Cross Blood Donor Center in Boston. He was also Director of Public Relations for the American Red Cross in that city.

Fabian Bachrach

WESLEY FULLER

Mr. Fuller was graduated from Harvard in 1933, and returned to the University on a Nieman Fellowship during 1938-39. He holds a commission as first lieutenant in the United States Marine Corps Reserve and had been released from duty following service in the Pacific, including the Okinawa campaign, prior to joining the Laboratories. Mr. Fuller reports to R. K. Honaman, Director of Publication.

Visible Speech to be Studied at the University of Michigan

Deaf education, speech correction, and other uses of visible speech, a development of the Bell Telephone Laboratories, will be the subject of an extensive research program that will be started this fall at the University of Michigan with the coöperation of the Michigan State Normal School of Special Education, nine miles from Ann Arbor in Ypsilanti, Michigan.

Center of the study will be the Speech Clinic of the University's Institute for Human Adjustment, with Dr. Harlan Bloomer as the director. Uses of visible speech in both speech and general education of deaf children will be carried on at the Normal School of Special Education, which is under the direction of Dr. Francis E. Lord.

Experimental equipment, used by the Bell Telephone Laboratories in early studies to determine the legibility of these speech patterns, will be loaned to the University of Michigan for the purpose. The original moving screen cathode ray translator will be set up at the State Normal College and a sound spectrograph with other equipment at the University.

Two temporary members of the Bell Telephone Laboratories' technical staff, who came from the educational field to take part in the early development of visible speech, will continue with the Michigan project. Dr. George A. Kopp will divide his time between an appointment as associate professor of speech in the University and activities as a research associate in the Speech Clinic. Miss Harriet C. Green is to become an assistant professor at Michigan State College and a research assistant in the University's Speech Clinic. It is anticipated that other units of the University will participate in the research in later phases of the project.

Vail Gold Medal Awarded for Julia Berry's Spirit of Service

The Bell System National Committee of Award for Theodore N. Vail medals recognized the supreme courage, loyalty and devotion to duty demonstrated by Julia Berry during the La Salle Hotel fire by posthumously awarding her a Gold Vail Medal and $1,000. Both will be presented to her son, John, age 16, who was left an orphan by his mother's tragic death.

"The Telephone Hour"

NBC, Monday Nights, 9:00 p.m.

September 9	*Jascha Heifetz*
September 16	*Lily Pons*
September 23	*Marian Anderson*
September 30	*Bidu Sayão*
October 7	*Fritz Kreisler*

The citation accompanying the award described Mrs. Berry's heroism as follows:

She was alone on duty at the switchboard of the twenty-two story La Salle Hotel, Chicago, when a disastrous fire started on the ground floor at about 12:30 a.m., June 5, 1946. The flames swept rapidly to the seventh floor before they were checked, and dense smoke poured upward through the entire building. Sixty-one persons lost their lives and many more were injured or overcome by smoke.

Mrs. Berry's post was on the second floor. When notified of the fire, she immediately called the Fire Department. Then, despite the oncoming smoke and flame, she set to work to spread the alarm throughout the hotel, calling room after room to warn people of their danger. Efforts were made to get her to leave. Twice she refused, saying there were many rooms that she had yet to reach. When the fire was over she was still at her post—her body slumped over the switchboard where she had chosen to stay and serve others, at the cost of her own life.

Mrs. Berry is the fifteenth to receive the gold medal since the establishment of the fund in 1920 in memory of Theodore N. Vail, former president of the American Telephone and Telegraph Company. This is the highest honor than can be awarded to telephone people for acts of heroism in giving noteworthy public service.

Two Islands Linked to Mainland by Microwave System

Nantucket Island, in the Atlantic Ocean off the Massachusetts coast, on July 2 joined Santa Catalina Island, in the Pacific off Southern California, in the distinction of being linked to the mainland by the first two commercial installations of a new microwave radio-telephone system. The service to Catalina was opened on May 27.

By means of the new radio-telephone systems, eight telephone circuits have been added by the New England Telephone and Telegraph Company and the Southern California Telephone Company, respectively, to the twelve circuits previously available to Nantucket and fifteen to Catalina through submarine cables.

In sharp contrast with the beacon fires and semaphore signals of Nantucket's early days is this modern communication magic. By it, words spoken into telephones in the ancient shingled houses on the narrow, cobbled streets of the old whaling port are carried by land telephone lines to a 42-foot tower standing on high ground in the rolling moorland some two and a quarter miles west of the town and are projected from it across Nantucket Sound to a similar tower about 30 miles away on a hill in the western part of the town of Barnstable on Cape Cod, there returning to land lines for transmission to their ultimate destination. The New England telephone people have named this tower location Manson Hill in honor of their late chief engineer, G. K. Manson.

On Santa Catalina the antenna tower and equipment house are located on a high

1946 • FIRST INTERNATIONAL INDUSTRIAL PUBLICATIONS CONTEST • 1946

Award

BELL LABORATORIES RECORD OF

BELL TELEPHONE LABORATORIES, INC.

IS PRESENTED THIS CERTIFICATE OF AWARD IN RECOGNITION OF EFFECTIVENESS OF DESIGN, EXCELLENCE OF EDITORIAL CONTENT, AND ACHIEVEMENT OF PURPOSE IN A CONTEST CONDUCTED BY THE NATIONAL COUNCIL OF INDUSTRIAL EDITORS, U. S. A., AND THE CANADIAN ASSOCIATION OF PERSONNEL PUBLICATION EDITORS

BOARD OF JUDGES:

Bell Laboratories Record *was one of 84 magazines out of 556 entries selected for an award in the First International Industrial Publications Contest. Announcement of the award was made at the convention in Boston of the International Convention of Industrial Editors which was attended by P. B. Findley and Wesley Fuller*

hill about 2½ miles from the island town of Avalon, while the other terminus of the installation is temporarily located on top of the telephone building at 433 South Olive Street, Los Angeles, 49 miles away.

Dr. Christensen Heads School of Mineral Industries

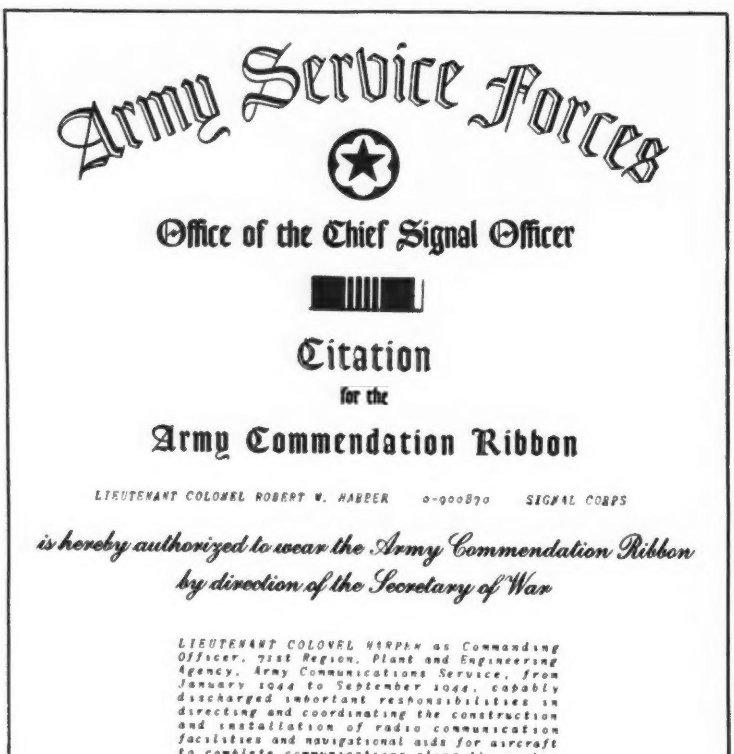
C. J. Christensen has been appointed dean of the School of Mineral Industries of the University of Utah. A native of Utah, Dr. Christensen received his B.S. at Brigham Young University, where he was an instructor in 1923 and again in 1926. He received his master of science degree at the University of Wisconsin and his doctor of science degree at the University of California. In 1929 he joined the Laboratories as a member of the Technical Staff. Since then he has pioneered in the making of carbon varistors and has made noteworthy contributions in the fields of ceramics and varistor materials and to the growing of synthetic crystals. During the past year he has been supervisor of a group engaged in the research and development of magnetic materials.

The School of Mineral Industries which Dr. Christensen will head was created by division of the School of Mines and Engineering and will include mining, metallurgy, mineralogy and allied subjects, and the basic earth sciences, geology, geography, ceramics and meteorology. The necessity for the new school was outlined recently in press releases by Dr. A. Ray Olpin, president of the University of Utah and a former member of the Bell Laboratories.

The Telephone Business

In many communities across America peacetime telephone conversations are now being carried by wire and cable originally intended to link Army camps. Thousands of telephone instruments, formerly installed in war plants and military posts, are being used. Millions of insulators, thousands of telephone poles, and huge amounts of pole-line hardware, all made for wartime purposes, are helping to relieve the Bell System's long waiting lists of applications for telephone service.

"War surplus" is the name given to this equipment. Much of it was manufactured by Western Electric and its purchase from the Government has become an extremely important phase of that company's job as supply unit for the Bell System. Pur-



Army Service Forces

Office of the Chief Signal Officer

Citation

for the

Army Commendation Ribbon

LIEUTENANT COLONEL ROBERT W. HARPER O-900870 SIGNAL CORPS

is hereby authorized to wear the Army Commendation Ribbon by direction of the Secretary of War

LIEUTENANT COLONEL HARPER as Commanding Officer, 71st Region, Plant and Engineering Agency, Army Communications Service, from January 1944 to September 1944, capably discharged important responsibilities in directing and coordinating the construction and installation of radio communication facilities and navigational aids for aircraft to complete communications along the routes of the Air Transport Command.

H. C. INGLES
Major General
Chief Signal Officer

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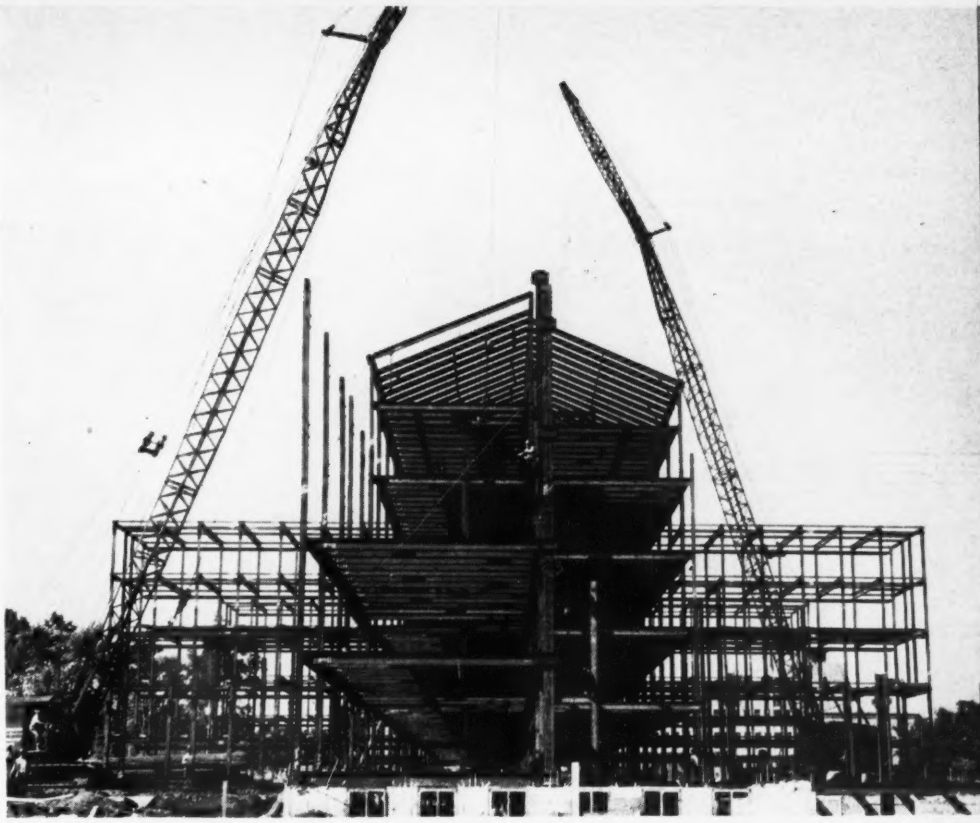
chases, as of August 1, have totaled approximately $7,500,000.

The major responsibility for buying the Government's surplus telephone equipment has been undertaken by the purchasing department at 195 Broadway, working closely with supplies inspection and the twenty-nine distributing houses. The job has become so extensive and so important that a special war surplus and materials policy committee was created, headed by Assistant Purchasing Agent W. F. Johnson of Western Electric.



Steel erection is practically complete on the new main building at Murray Hill

Materials being declared surplus by the Government include standard Western Electric telephone equipment. Other surplus items are not of Western Electric make but meet Bell System specifications. Still other items vary from our specifications, but are usable as substitutes. Materials of interest are of two kinds: (1) equipment, including cable, telephone sets, carrier apparatus, and PBX boards, and (2) supplies items, such as wire and strand, poles and crossarms, strand and steel wire, hardware, and motor vehicles.

Inter-City Mobile Radio

Three more inter-city highways, totaling over 800 miles in length, have been added to the two previously announced routes on which the Bell System plans to provide mobile radio-telephone service to vehicles. The A T & T has announced that applications have been made to the Federal Communications Commission for authority to construct experimental stations along the highways between Washington and New York; Buffalo and New York, via Albany; and Los Angeles and San Diego. Permits to build transmitters and receivers for highway mobile radio-telephone service between New York and Boston and between Chicago and St. Louis already have been granted and construction of those stations is under way.

On the New York-Washington highway, it is planned to build transmitting and receiving stations near New Brunswick, Philadelphia, Wilmington, Baltimore and Washington.

The New York-Albany-Buffalo route is the third major highway in the thickly populated eastern part of the country on which radio-telephone service for mobile units is planned by the Bell System. In addition to the station in New York City, transmitter-receivers are to be located near White Plains, Poughkeepsie, Albany, Fonda, Utica, Syracuse, Rochester and Buffalo.

To serve vehicles on the heavily traveled highway between Los Angeles and San Diego, transmitter-receivers will be erected on Mt. Wilson and Mt. Woodson, near the respective cities. From those two commanding locations it will be possible to cover the entire 125 miles between the two communities.

Applications for Bell System highway mobile radio-telephone installations in a number of other cities, including Cleveland, Grand Rapids, Knoxville and Mobile, are pending or in preparation.

This is the Croix de Guerre Medal awarded to Col. Frank A. Parsons by the French Government for the part he played during World War II in the liberation of France. The Croix de Guerre is awarded in three ranks and it is the highest of these, the award "avec etoile de vermeil," which was conferred on Col. Parsons

Do You Like to Sing?

A cordial invitation to become members of the Murray Hill Chorus is extended to all Laboratories' men and women who live in the vicinity of Summit. The chorus will rehearse at the Summit Y.M.C.A. on Tuesday evenings from 8 to 10 o'clock so that those who work at West Street and other locations may be able to join the group.

The first fall rehearsal will be on September 17, when it is hoped that all former members and many new ones will be on hand to start the chorus on its way to another successful year.

Paul Kuhn, as executive chairman of the chorus, has Phyllis Taylor as his assistant, with Reine L. Levesque, secretary; William Vierling, treasurer; Beatrice J. Panos, librarian; and C. Tanis in charge of membership.

News Notes

A NEW BOOK by R. A. HEISING, *Quartz Crystals for Electrical Circuits,* has been recently published by D. Van Nostrand Company. The book is a compendium of up-to-date information, both theoretical and practical, on quartz crystal plates, their design and manufacture. Included in the book are chapters written by W. P. MASON, W. L. BOND, ELIZABETH J. ARMSTRONG, G. W. WILLARD, R. A. SYKES, H. J. MCSKIMIN, G. M. THURSTON, H. W. WEINHART, H. G. WEHE, I. E. FAIR, A. R. D'HEEDENE, R. M. C. GREENIDGE and C. W. HARRISON.

P. S. DARNELL visited the Allen-Bradley plant in Milwaukee with representatives of the Western Electric Company to discuss requirements and inspection practices for resistors purchased by Western Electric.

L. S. C. NEEB discussed control apparatus at the Westinghouse Electric Company.

J. H. BOWER discussed battery problems with the Bureau of Standards.

K. K. DARROW spoke on *Physics and the Public* on July 16 before the Chapter of Sigma Xi at the Shell Development Company, Oakland. Dr. Darrow attended the American Physical Society meeting in July at Berkeley, California.

O. H. DANIELSON, G. E. PERREAULT and I. V. WILLIAMS of the Laboratories and J. A. Burkart of the Western Electric Company visited the Massachusetts Institute of Technology concerning a Navy project.

J. R. POWER and G. J. V. FALEY were in Burlington, N. C., on engineering problems associated with hearing aid production.

During the Four Months Ending With June, the United States Patent Office Issued Patents on Applications Previously Filed by the Following Members of the Laboratories:

H. H. Abbott
S. M. Babcock
H. M. Bascom
J. Baumfalk
R. Black, Jr.
J. T. L. Brown
F. G. Buhrendorf
J. W. Clark
B. Dysart
P. G. Edwards
K. M. Fetzer
A. G. Fox
H. T. Friis
R. R. Galbreath
E. W. Gent
A. A. Hansen
R. E. Hersey (2)
A. W. Horton, Jr.
F. A. Hoyt
J. L. Hysko
M. A. Logan
H. D. MacPherson (2)
A. Majlinger
W. P. Mason
L. A. Meacham
W. J. Means
R. S. Ohl (4)
G. L. Pearson
W. T. Rea
A. R. Rienstra
V. L. Ronci
A. L. Samuel
J. H. Scaff
W. G. Shepherd
T. Slonczewski
B. E. Stevens
K. D. Swartzel, Jr.
R. L. Taylor
E. A. Thurber
J. R. Wilkerson
G. W. Willard (2)
S. B. Williams
L. A. Wooten

V. T. Wallder has been named to serve as a member of A.S.T.M. D20 subcommittee on Polyethylene.

V. E. Legg has received honorable mention in the field of theory and research for his paper, *Optimum Air Gap for Various Magnetic Materials in Cores of Coils Subject to Superposed Direct Current,* in the 1945 national prize paper awards of the A.I.E.E. In 1940 Mr. Legg was awarded the National Prize for Initial Paper of which F. J. Given was co-author.

G. L. Pearson, P. W. Foy and W. Shockley visited the National Bureau of Standards to make measurements of conductivity and Hall Effect in silicon and boron semi-conductors at liquid and solid hydrogen temperatures.

Engagements

Stewart M. Beekman—*Margaret Scharnke
Harold Boland—*Cecelia Cooney
Sal Cangemi—*Frances Giambalvo
Walter Chambers—*Virginia Davis
*Robert F. Graham—June Gibson
John Harrington—*Genevieve Sokolosky
*Paul T. Haury—Annetta Christensen
Harry E. Hechtman—*Florence Doris
Dacel S. Lawrence—*Helen Asher
*Leo Luckner—*Nellie Schofield
Lawrence L. Morrill—*Catherine Denninger
Thomas J. Murphy, U. S. Navy—*Dorothy Goll
William F. Ocenasek, Jr.—*Daniela Sidla
Joseph Porcelli—*Dorothy Carney
Stanley M. Raines—*Selma Graber
William Rigney—*Margaret Heussler
Jerome Spina—*Mary Sheridan
*Thomas W. Thatcher, Jr.—Lois Constance
J. Arthur White, Jr.—*Miriam White

Weddings

*A. B. Anderson—Ruth Johnson
*Kenneth S. Cadmus—*Wilma Sabolsak
Stephen G. Dorosh—*Virginia Voskanyan
David L. Fisher—*Dorothy Bebb
*Howard C. Fleming—Cecelia Toughey
*R. Shiels Graham—*Isolde Holoch
Walter G. Henry—*Isabelle Simpson
Robert E. Huddy—*Elizabeth Loch
L. Thomas Leonard—*Ruth Kampfe
*Robert H. Meuser—Alyce Benjamin
*John C. Pfaff—Muriel Jenkins
Wesley G. Rogers—*Rose Slater
*George J. Wolters—Catherine Clancy

*Members of the Laboratories. Notices of engagements and weddings should be given to Mrs. Helen McLoughlin, Room 803C, 14th St., Extension 296.

Noon hour on the grounds at Murray Hill suggested a picnic to a photographer who posed this group of girls. On the wall are Janet Brown and Peggy Anderson; on the lawn, Mary Murray, Jean Gutleber, Muriel Bey and Georgia Plumridge, all of the Murray Hill Service Department

R. H. Colley and J. Leutritz, Jr., attended a conference at Forest Products Laboratory on culture technique for evaluating modern wood preservatives.

C. S. Fuller, W. O. Baker and P. P. Debye attended the High Polymer Conference of the American Society for the Advancement of Science at Gibson Island. Dr. Baker, who is chairman-elect of the 1948 High Polymer Conference, presented a paper on *Structure of Synthetic Rubber.*

C. J. Frosch, R. C. Platow, W. O. Baker and R. Burns attended the A.T.S.M. meeting in Buffalo, at which Mr. Platow was elected chairman of Committee D-14 on Adhesives.

A. C. Ekvall of Transmission Apparatus Development has received an M.S. degree from Stevens Institute of Technology.

Oliver Heaviside—Humorist, an article by C. M. Hebbert, was published in the June '46 *Journal of the Franklin Institute.*

C. H. Amadon has been investigating current production and treating problems with suppliers for the telephone industry of poles and crossarms in the Mountain States and Pacific coast areas.

G. M. CAMPBELL A. D. HARGAN J. C. WRIGHT

Recent retirements from the Laboratories include J. C. WRIGHT with 36 years of service, July 31; and A. D. HARGAN, 40 years, and G. M. CAMPBELL, 39 years, on August 31.

GUY M. CAMPBELL

Mr. Campbell was graduated from Purdue University in 1904 with a B.S. degree in E.E. and entered the Automatic Electric Company. In March 1905 he left to join the Western Electric at Clinton Street where, after terms in the Student Course, Inspection Department and Equipment Engineering, he decided to become a patent attorney. He served with a Chicago patent law firm and received an LL.B. degree from Kent College of Law.

In November 1909 Mr. Campbell returned to Western Electric Company as a member of the newly established patent department at New York. His Bell System patent experience has been very diversified, including telephony, both manual and automatic, printing telegraphs, public address systems, sound pictures, speech recording, phonographs, acoustics and measuring and testing. From 1918 to 1922 he was in charge of the patent group at Hawthorne. Since 1938 he has been concerned with investigations of patents and inventions of outsiders of possible interest to the Bell System. He has also handled questions submitted by A T & T relating to inventions and technical suggestions by employees of the Associated Companies. The war added to his duties supervision of reports to the Government authorities on inventions originating in connection with Government contracts. He is a member of the Bar of the State of New York and of a number of Federal Courts.

AUGUSTUS D. HARGAN

After graduation from Webb Institute of Naval Architecture and Marine Engineering, Mr. Hargan joined the Western Electric Company in New York in 1906 as a draftsman on cabling plans for central offices. After two years on this work, he transferred to the apparatus drafting group, and then was made chief draftsman of the manufacturing organization in New York.

Mr. Hargan went to Hawthorne in 1913 to take charge of technical correspondence for the Manufacturing Department. After two years in this capacity and a year in charge of one of the drafting divisions, he returned to New York, where, in the Engineering Department, he was concerned with the design and development of panel dial apparatus. He continued this work until 1928, devising improvements and refinements of the apparatus and supervising a group from 1925 to 1928. He then transferred to the repaired apparatus group, where he engaged in studies of the economics and requirements for repaired apparatus, particularly on station telephone and teletypewriter apparatus. He supervised this type of work from 1935 to 1942.

Mr. Hargan conducted the Laboratories Out-of-Hour Course in Manufacturing Methods in 1934-35 and again in 1936-37.

At the outbreak of the recent war, he transferred to the Commercial Products Development Department at Whippany, where he was concerned with the mechanical design of electronic computers for solving the problems connected with the development of airborne radar navigation and bombing.

JAMES C. WRIGHT

Mr. Wright, of Transmission Apparatus Development, received the M.E. degree from Cornell University in 1909 and directly entered the student training course at Hawthorne. The following year he transferred to the Physical Laboratories at West Street where, during his work on dry cells and portable storage batteries, he made important contributions to standardized test methods and automatic test equipment. He handled the development and construction of precisely controlled air conditioning equipment which has continued in use in the Laboratories for duplicating atmospheric conditions to which telephone apparatus is subjected in service.

Although his experience included a diversity

of apparatus projects, Mr. Wright's major responsibility was supervision of work on incandescent lamps and switchboard signaling through a time when tungsten filament switchboard lamps went into large-scale use, when resistance lamps were first designed to meet specific circuit conditions, and when testing of illuminating lamps was introduced. During World War II, Mr. Wright was called in on the development of wire used in electronic equipment for the Armed Forces. In this, his former experience in dealing with the behavior of wire and cable insulations under various test and service conditions enabled him to make valuable contributions.

News Notes

Morgan Sparks discussed new types of batteries at the National Carbon Company in Cleveland and at the Bureau of Standards in Washington.

Mary N. Torrey of Quality Assurance received an M.A. degree from Columbia University in June.

Eleanor K. Bly of Apparatus Staff has received a B.S. degree from N.Y.U.

J. F. Morrison read a paper on *Designing FM Antennas* at a meeting of the Maryland section of the I.R.E.

L. Vieth has been appointed to Subcommittee F on Audiometry and Hearing Aids of the A.S.A. Committee on Acoustical Measurements and Terminology.

T. A. Durkin, in company with Western Electric engineers, discussed cable production problems at the plant of the Surprenant Electrical Insulation Company.

J. E. Cassidy and R. C. Terry went to the Patent Office in Washington during July on patent matters.

S. M. Sutton and D. C. Smith conferred on clay conduit specifications at the Haydenville, Ohio, plant of the National Fireproofing Corporation.

O. E. Buckley, R. L. Jones and R. K. Honaman attended the Bell System Public Relations Conference from July 16 to 18 at Absecon, N. J.

Dr. Buckley has been appointed a member of a special Advisory Committee on Ordnance Research and Development formed by the Army Ordnance Association in response to a request from Major General Everett S. Hughes, Chief of Ordnance. This committee will take a leading part in the broad solution of problems in the field of Ordnance research and development.

Harvey Fletcher has been appointed chairman of the committee charged with reviewing the policy of the American Physical Society with respect to divisions.

W. C. Herring has returned to the Laboratories after a five months' leave of absence, during which he taught at the University of Texas.

F. F. Romanow attended a meeting of the Executive Committee of the Sound Equipment Section of the Radio Manufacturers' Association in regard to the standardization of microphone and loudspeaker performance.

G. W. Meszaros visited Chauncey, Ga., where modifications of rectifier-inverters for power supply on coaxial systems were under test.

J. F. Polhemus, H. A. Lewis and H. Keppicus visited the coaxial equipment at the Washington, D. C., Toll Office of the Long Lines Department.

September Service Anniversaries of Members of the Laboratories

40 years

A. L. Fox

35 years

E. L. Vibbard
Ladislaus Von Nagy

30 years

J. L. Allison
E. G. Fracker
H. B. Gilmore
E. A. Whelan

25 years

L. H. Allen
R. I. Crisfield
E. L. Erwin
V. J. Mayer
Oscar Myers
F. J. Raile
A. B. Reynolds
George Riggs
W. W. Seibert
A. L. Whitman
H. W. Wightman
S. M. Wikel

20 years

Clarence Anderson
V. H. Baillard
J. T. Dixon
J. L. Doncourt
H. G. Fisher
C. E. Germanton
R. W. Gutshall
C. L. Johnson
W. C. Kirkman
W. E. Kirkpatrick
R. C. Koernig
A. H. Kuhlman
L. R. Lowry
E. C. McDermott
Daniel McNamara
R. G. Orton
R. E. Polk
H. J. Talty
H. N. Wagar
H. G. Wehe
F. H. Willis
W. H. Wise

15 years

James Barr
George Simco

10 years

W. R. Davis
R. S. Duncan
Ruth Fleischmann
W. W. Grote
Eleanor Guerci
F. M. Hodge
M. P. Hughes
G. F. G. Kastner
A. W. Koenig, Jr.
R. A. LeMassena
G. T. Loman
Beulah Marion
J. H. Miller
J. R. Pierce
William Shockley
F. M. Thayer
P. H. Thayer, Jr.
D. E. Wooldridge


Lt. Gould


R. E. Poirier


Capt. Hoth


Frances V. Tracy


W. E. Wilson


Ens. Bracken

Capt

Recently Returned Veterans

Lieut. Leon M. Gould, upon entering the Air Corps, became a Link trainer instructor, was later assigned to study at the University of California, and subsequently was stationed as a platoon commander giving basic training at Fort Leonard Wood.

Robert E. Poirier engaged in radar maintenance and development at St. Simon Island, Georgia, and in radar beacon maintenance at bases in Cuba and Key West before studying at Vanderbilt University.

Capt. Daniel F. Hoth spent three and a half years in the Signal Corps in Arlington, Virginia. Entering service in December, 1942, as a Second Lieutenant, he spent most of his time in the Army directing a group of military and civilian personnel engaged in the development of special communications equipment. In the summer of 1945, for two months, he investigated certain German wartime development activities in Germany.

Frances V. Tracy was recently released from the Naval Reserve with the rank of Aerographer's Mate 3/c. During her war service she was a weather observer stationed at Banana River, Florida.

Warren E. Wilson's military service was spent at the Infantry School, Fort Benning, where he was attached to the Secretary's Office as clerk and served as driver on special missions for the General.

Ensign Marvin Bracken served eighteen months in the Navy as an aviation cadet, following which he was commissioned in the Coast Guard, where he was engaged in air-sea rescue operations in the New York area.

Donald A. Loughlin participated in the invasion of Okinawa and in occupational landings at Korea and Tientsin, China, as a member of the *Arcturus*, an amphibious cargo attack ship.

Andrew Olsen became team chief of a telephone installation and maintenance group which took over and operated French installations at Metz and Nancy, and later did similar work on the German installation at Wiesbaden.

Donald J. Oakley was assigned on two occasions to the Asiatic-Pacific theater of war. First he was land-based on the Solomons and Admiralties and assigned to the Fleet Air Wing; then he returned to the States for special training and was assigned to duty on Okinawa and in Japan.

Wallace C. Hickman served for over three years in the Signal Corps. After specialized training at Camp Crowder, he was engaged in radio teletype transmitter installation work at Algiers.

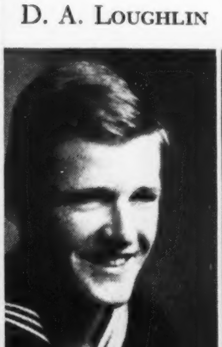
Gilbert Goodman has returned to the Chemical Department from military leave following approximately two years in the Army. He served nineteen months in the Pacific theater of operations. Part of the time he was connected with the Manila real estate branch office.

Chief Vincent J. McCarthy returned to the Development Shop at Murray Hill after nineteen months in the Pacific area, where he was engaged as a Chief Machinist's Mate in the repair of naval vessels damaged in enemy action.

Capt. Charles L. Semmelman, a reserve officer in the Signal Corps, upon entering service became Assistant Officer in Charge of the Performance Test Section, of the Signal Corps Engineering Laboratories, Fort Monmouth. This Section performs any required test on all parts and materials considered for use in Signal equipment except tubes, crystals and batteries. During the war, the Section prepared nearly 10,000 written reports on the results of tests and assisted in the preparation of nearly all JAN specifications by furnishing data on parts previously tested.

Bartholomew A. Stiratelli received Marine Corps boot training at Parris Island and Camp Lejeune and was assigned to a corps of mainte-

D. A. Loughlin

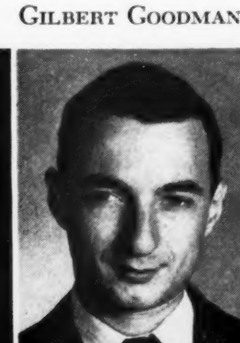


Andrew Olsen

D. J. Oakley

W. C. Hickman

Gilbert Goodman



Chief McCarthy

CAPT. SEMMELMAN B. A. STIRATELLI MAJ. FLUSKEY CAPT. WOODS LT. WALSH CAPT. ADAMS

nance engineers in the Marine Corps Ordnance Division located in Washington, D. C.

Major Robert J. Fluskey has returned to the Laboratories upon completion of thirty-eight months in the Army. He volunteered in April, 1943, accepting a direct commission as First Lieutenant, Signal Corps. His initial six months were spent as Control Officer of Toms River Signal Laboratory, Signal Corps Ground Signal Agency. The following twenty-two months involved assignments as engineering, contracting and production-expediting officer for Monmouth Procurement District of the Signal Corps Production and Distribution Service, for which he received two commendations. After several months in a staff capacity in the office of the Chief Signal Officer at the Pentagon, Major Fluskey, subsequent to V-J Day, was assigned to the Cambridge Signal Patent Agency, which is located at M.I.T. and Harvard, and of which he was executive officer when he went on terminal leave.

Capt. Thomas G. Woods, Jr., has been reverted to inactive duty after service with the Signal Security Agency at Washington, and with the Signal Intelligence Service, operating out of Australia and the Philippines during the war. He also served at SIS Headquarters, Kyoto, Japan, as well as in Manila after peace was signed, and for a short time in Washington upon his return.

Lieut. James R. Walsh, a pilot, instructed in twin engine trainers before receiving specialized training in Troop Carriers. In the ETO, he flew his C-47 on re-supply missions and on the Rhine Drop. Returning to Fort Bragg, he was an instructor of a Troop Carrier Group until he was released.

The Laboratories has employed 1,113 veterans of World War II

Capt. Helen G. Adams, after receiving her basic training, was assigned to general duty in the Neurosurgical Department at Halloran General Hospital, where she later became Assistant to the Chief Nurse. Capt. Adams was transferred to Fort Lewis, Washington, where, while training for service in the Far East, she was stationed with the 122nd General Hospital. After V-J Day she served as Assistant to the Chief Nurse at Borden General Hospital, Chickasha, Oklahoma, until her recent return to the Medical Department nursing staff at West Street.

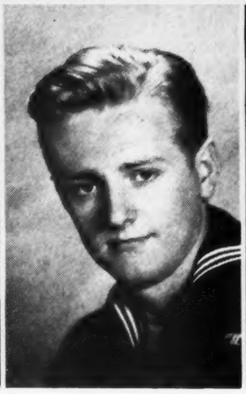
George A. Sharpe's naval assignment was at Mechanicsburg, Pa., where, as a Storekeeper Technician, he was responsible for checking all requisitions for electrical motors and controllers, advising the section if material was in stock and ordering the items needed.

Chief H. John Geisler, CETM, did submarine work at New London before being assigned to the staff of Radio Matériel School, Washington, D. C., where he taught *Antenna, Transmission Lines and Wave Guides* for over two years.

F/O William R. Spenninger, after commissioning, instructed in navigation for eight months before being assigned to train for B-29's. Overseas he flew with the 20th Air Force, based on Saipan, on bombing missions over Japan until V-J Day and then was assigned to flying supplies from Saipan and Guam.

Albert R. Strnad, while at B-29 gunnery school, helped design the Hobson-Strnad Trainer, which he later used at various airfields and in Detroit for experiments in teaching gunners in the proper use and firing of the B-29's gunnery system. Patent application for the trainer is being searched.

HY G. A. SHARPE CHIEF GEISLER F/O SPENNINGER A. R. STRNAD LT. WOITOVICH VICTOR SILZER

ENS. ELLIOTT — LT. DOHERTY — CHIEF DALM — H. B. COMPTON — R. A. HAUSLEN — R. M. EICHHORN

Lieut. John M. Woitovich received his commission at the Midshipman's School on the *Prairie State* and attended submarine school prior to becoming Assistant Engineer and Electrical Officer on the submarine *Blackfin*, which operated out of Australia and the Philippines.

Victor Silzer taught radar at Boca Raton before his assignment at the international military trials at Nuremberg, where he translated original documents written by Hitler and Goering.

Ensign John V. Elliott, who received a direct commission in the Navy, trained at the Naval Communications Center, Harvard University, before being assigned as Communications Officer on the *Mt. McKinley*. He also served on minesweepers in Japan, Korea and China waters.

Lieut. Thomas J. Doherty was a detachment commander with Hq. 4th Air Forces at Hamilton Field and a security officer in San Francisco before being assigned in India for a year as Security Intelligence Officer. He was also assigned to a tactical team with the British 14th Army in Burma and in Rangoon, and later was reassigned to India.

Chief Charles H. Dalm, ACETM, received specialized training in radio and radar maintenance schools and at sea before being assigned to the *Wasp*, which participated in battles on the Philippine Sea and on which he traveled to much of the Far East, including Japan.

Harry B. Compton served as radio operator on the destroyer *Kearny*, and, after advanced schooling as radio technician, on the *Semmes* and, in Pacific waters, on the *Altair* and the *Laffey*.

Robert A. Hauslen's varied naval career included aviation cadet training; ETM schooling; and duty on the destroyer *Cowell* during the invasion of Okinawa, at Pearl Harbor and at Saipan.

Robert M. Eichhorn served in the Navy for over three years, first as a cadet and later, after specialized training, as an electronic technician's mate at bases maintaining electronic equipment.

Frank A. Chionchio has returned to work in Building T after nearly three years of naval duty, most of it in the Pacific, where, after training in ETM School, he served on the *Freemont*.

Richard Rafferty, assigned to Frankford Arsenal, traveled from there on field trips to work on ordnance material and to instruct in fire control material. Later he transferred to the Air Corps.

Lieut. William H. Christoffers earned the Air Medal for "bombing nine enemy planes on four runs at low altitude." An aerial navigator, he flew in a patrol bomber with the VB 115 Squadron of the 7th Fleet and in over 1,000 flying hours the plane was credited with 8 ships and 12 planes.

Matthew Tomb spent twenty-six months in the Navy, of which he served twenty months in the Pacific aboard the submarine tender *Appollo*.

Thomas J. Comparetta, a B-29 gunner, was based on Tinian and Okinawa during three hundred hours of flying time. Later he made trips to the Philippines, Korea, China and Japan, where his plane made pictures of the atom bomb havoc.

Kenneth A. Josephson was awarded the Purple Heart for wounds received by machine-gun fire on Okinawa while fighting with the 6th Marine Division Infantry. Later, after hospitalization on Guam, he was assigned to the Military Government there and stationed in a native village until his release.

Leaves of Absence

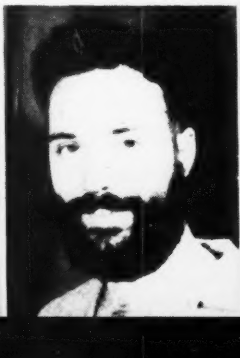
As of July 31, there had been 1,052 military leaves of absence granted to members of the Laboratories. Of these, 827 have been completed. The 225 active leaves were divided as follows:

Army 101 — **Navy 88** — **Marines 7**

Women's Services 29

There were also 10 members on merchant marine leaves and 1 on personal leave for war work.

F. A. CHIONCHIO — RICHARD RAFFERTY — LT. CHRISTOFFERS — MATTHEW TOMB — T. J. COMPARETTA — K. A. JOSEPHSON

Looking for Japs 321

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